MACHINERY

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# *Portable Precision Grinders Find Universal Use*

*The Versatility of This Type of Grinding Equipment Makes it a Convenient and Economical Auxiliary for Almost Every Kind of Machine Tool*

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*Dumore Co., Racine, Wis.*

PRECISION grinding on the lathe, boring mill, shaper, planer, milling machine, and other types of machine tools was made possible through the development of what has been commonly known as a "lathe grinder." This name, obviously, is a misnomer, in view of the fact that this grinding equipment is adapted to many other machine tools besides lathes. Grinders of this type can finish parts to specified dimensions within an accuracy of 0.0001 inch, and therefore the term "portable precision grinder" would seem a more accurate one to apply to these tools.

Portable precision grinders, made by the Dumore Co., are illustrated in this article applied for cylindrical, internal, form, and surface grinding under a variety of conditions. They facilitate the complete machining of work on a lathe, planer, or other machine tool in a set-up that requires little time to make and that may be necessary anyway for preliminary cuts. These grinders are particularly suitable for precision tool-room work and small-lot manufacturing jobs.

The application of these grinders in the operations shown resulted in an appreciable reduction

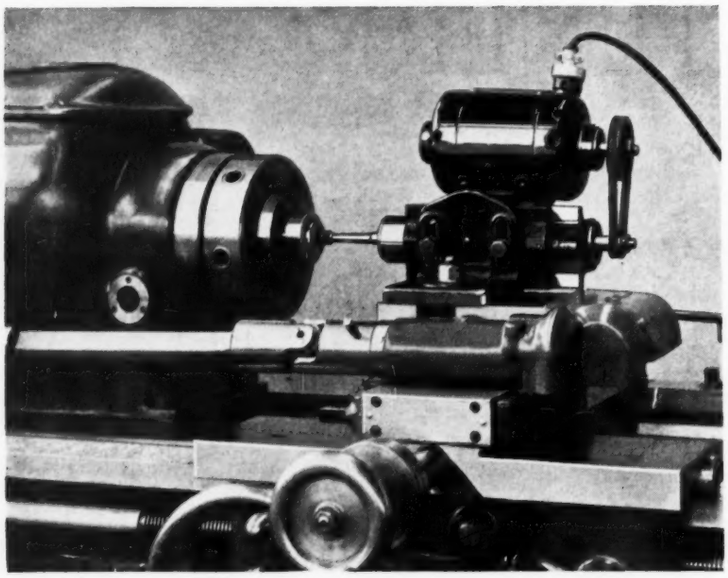


*Fig. 1. Grinding Lathe Collets with a Portable Precision Grinder Mounted on the Cross-slide of the Lathe in which the Collets will Actually be Used*

in set-up time and enabled accurate grinding to be performed with inexpensive equipment. Portable precision grinders are entirely self-contained, being driven by independent motors.

### *Internal and Cylindrical Grinding Operations Performed in Lathes*

Spindle speeds as high as 42,500 revolutions per minute can be provided on these grinders to adapt them to the internal grinding of holes as small as 1/8 inch in diameter, and there is no limit to the dimensions of work that can be ground cylindrically. The heading illustration shows a portable precision grinder being used on a lathe in a machine tool plant for the accurate internal grinding of collars that have been previously rough- and finish-bored.

In another machine tool plant, a portable precision grinder is used, as shown in Fig. 1, for grinding the holes of collets while they are assembled in the spindle quill of the lathe in which they are to be used. In this operation, as well as that shown in the heading illustration, the grinder is mounted on the lathe cross-slide and is reciprocated in the rotating work by means of the lathe lead-screw. The grinding wheel is trued in relation to the center of the work by means of a diamond dresser attached to the lathe spindle.

While both of the preceding jobs consist of accurately grinding a single hole in a part, operations are being performed with portable precision grinders in which two holes are accurately ground in line with each other. In operations of this type, an extension spindle is used on the grinder, and the work is mounted on the faceplate of a lathe.

The cylindrical surface of a large piston for a hydraulic hoist was reconditioned through the use of a portable precision grinder equipped with an 8-inch grinding wheel and mounted on a heavy-

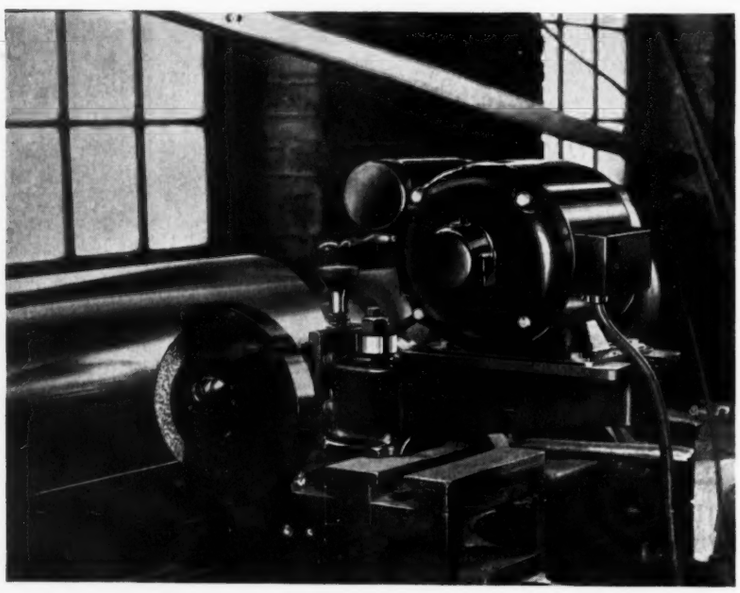


*Fig. 2. Reconditioning a Piston for a Large Hydraulic Hoist by Means of a Portable Precision Grinder Mounted on a Heavy-duty Lathe*

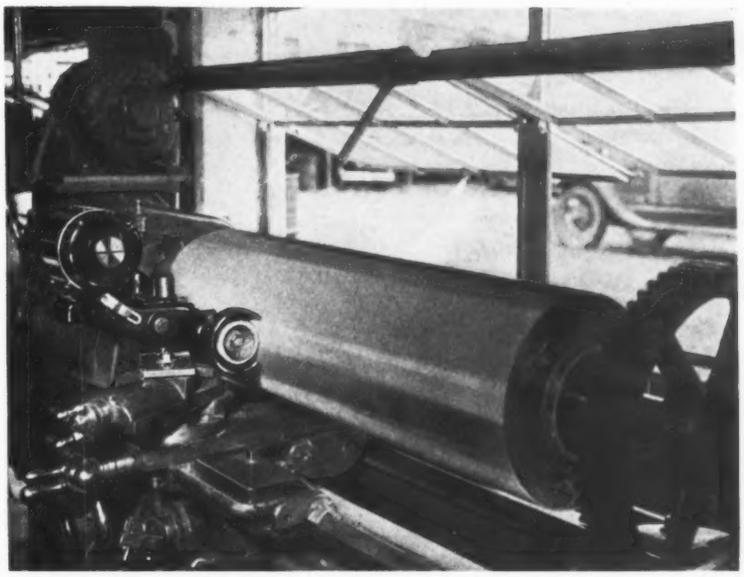


*Fig. 3. Portable Precision Grinders Equipped with Cup-shaped Wheels are being Used to Maintain the Required Surface Condition of Large Rubber Rolls*

duty lathe, as shown in Fig. 2. This hoist piston was about 12 inches in diameter by 10 feet in length. Originally, the hoist piston was finished on a roll grinder, but there was no machine of that type available in the shop that was called upon to do the reconditioning, and the portable precision grinder was used with complete satisfaction and at a low cost.

Rubber rolls, such as are used in mercerizing plants, cotton dyeing and finishing mills, bleacheries, and paper mills, must be ground from time to time in order to maintain a smooth, cylindrical surface. Fig. 3 shows an operation of this kind being performed by means of a portable precision grinder equipped with a cup-wheel of small diameter. The rubber roll here shown is 12 inches in diameter and was run at about 25 revolutions per minute for the grinding operation. Use was made of a cup-wheel because only a narrow width of rubber can be ground at a time without creating so much heat as to produce a harmful effect on the rubber.

Rolls of this type vary in softness. Some of them can be finished with one grinding cut, while others require two. The small cup-wheel eliminates the "cushion chatter" which occurred when 10- or 12-inch wheels of 1-inch face width were employed. The cup-wheels are of 30 to 46 grit and of grade K. They are run at a speed of about 6000 feet per minute.

### *An Unusual Form-Grinding Operation in a Lathe*

Tube forming rolls are ground to the desired peripheral contour by means of a grinder mounted on a lathe carriage in the manner shown in Fig. 4. Plates are mounted vertically on the carriage and the grinder unit attached to these plates with the grinding spindle uppermost. A 2 1/2-inch diam-

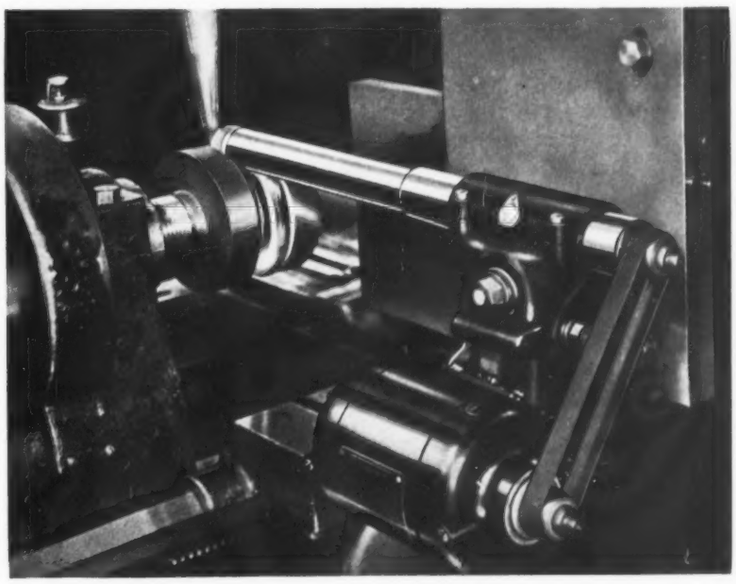


*Fig. 4. Grinding a Roll for Tube Forming Operations by Means of a Portable Precision Grinder Mounted on the Front of a Lathe Carriage*

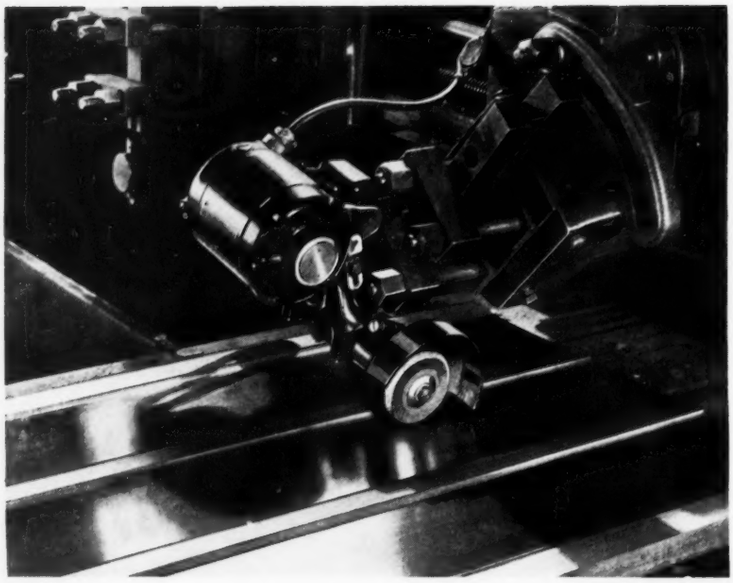


*Fig. 5. Using a Portable Precision Grinder on a Planer for Finishing the Long Flat Surfaces of a Steel Mold for Rubber Baseboards*

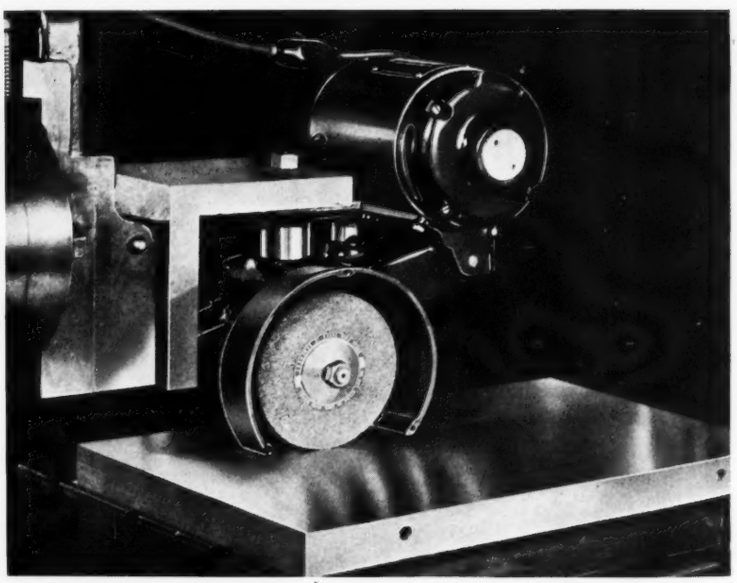


*Fig. 6. The Versatility of the Portable Precision Grinder also Permits its Use on Shapers for Surface Grinding Operations*

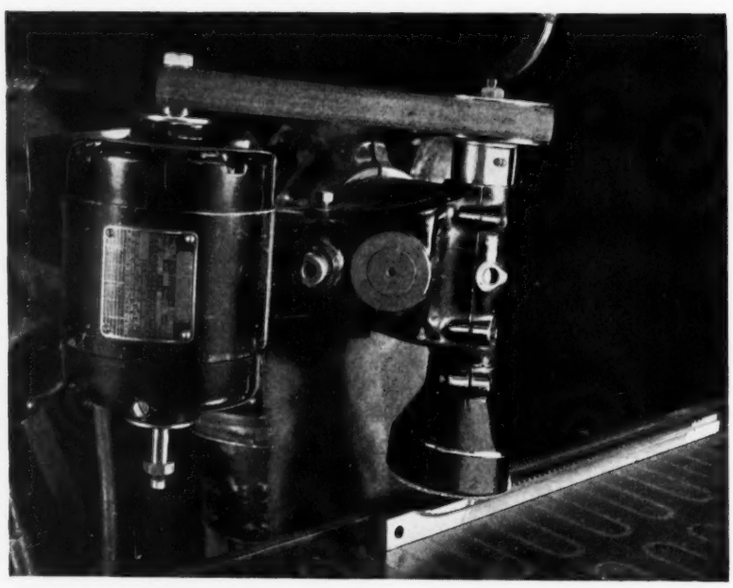


*Fig. 7. The Use of a Portable Precision Grinder on a Broach-sharpening Machine for Grinding the Teeth of a Narrow Broach*

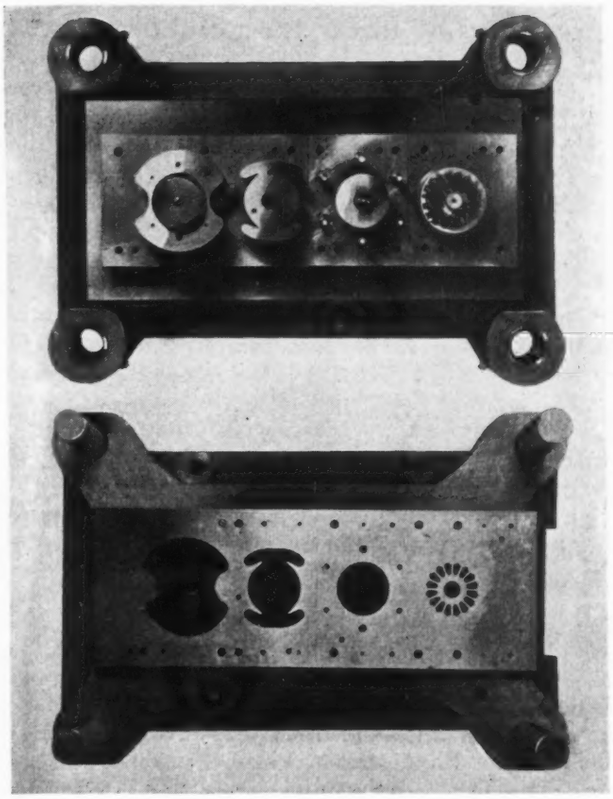


*Fig. 8. Die Set for Motor Laminations on which Fifty-seven Separate Grinding Operations are Performed by the Use of Portable Precision Grinders*

*Fig. 9. Milling Machine Equipped with a Portable Precision Grinder for Performing Many of the Operations on the Die Set Illustrated in Fig. 8*

eter grinding wheel is mounted on the end of a spindle that extends approximately 12 inches beyond the grinder support. Even with this extension, the groove is ground in the rollers accurate within 0.0001 inch. The lathe cross-slide is fed in and out approximately 2 inches in its successive passes across the work. The rolls have been rough-machined to the required shape and also hardened previous to the grinding operation.

### *Planer and Shaper Applications of Portable Precision Grinders*

Portable precision grinders can be conveniently applied to planers, as will be apparent from Fig. 5, for the surface grinding of long flat pieces or for grinding slots, keyways, etc., in parts. In the particular operation shown, flat surfaces are being ground in a multiple type of steel mold for rubber baseboards. This mold was approximately 4 feet long. It was necessary to tilt the grinder spindle at an angle, in order to avoid interference between the grinder unit and the work. However, the grinding wheel was dressed to cut its full face width.

The application of a grinder to a shaper is illustrated in Fig. 6, which shows the grinding of a lay-out plate approximately 20 inches long by 18 inches wide, level from corner to corner within 0.0003 inch. The grinder is attached to an angle-plate, which, in turn, is mounted on the tool-head of the shaper ram. The table is fed sidewise approximately the width of the grinding wheel upon the completion of each forward and return stroke of the shaper ram.

### *The Use of Portable Precision Grinders on Milling Machines Speeds up Diemaking*

Fifty-seven distinct grinding operations are performed with Dumore portable precision grinders in making a progressive punch and die set of the type shown in Fig. 8, which produces rotor and stator laminations for small motors. These die members are made up of forty-three separate parts which are finished so accurately by grinding that it is difficult to detect the outline of the various pieces with the naked eye after they have been assembled in the punch and die. Many of the grinding operations on the individual parts of this die set are performed with a grinder mounted on a lathe, but others are accomplished with a grinder mounted on the outer arbor support of a milling machine, as shown in Fig. 9.

A milling machine set-up of this type is especially advantageous when contours must be ground. In the case of the die set shown in Fig. 8, the large

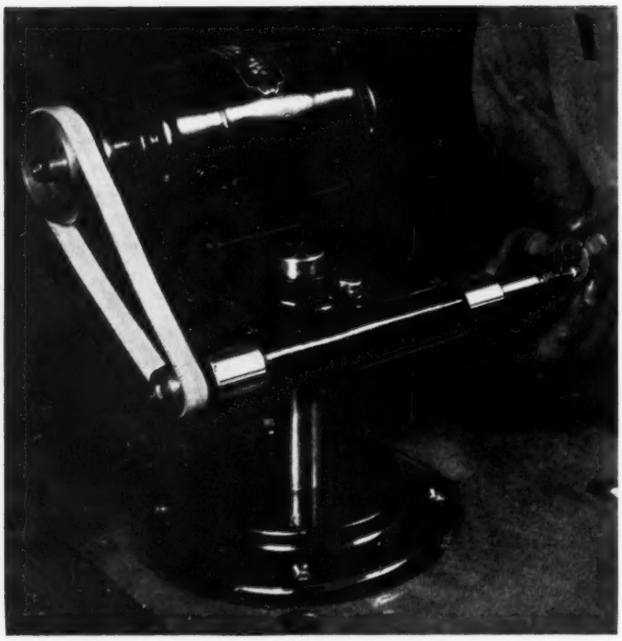


*Fig. 10. Grinding the Clearance Holes in a Button Die by Means of a Bench-mounted Grinder*

openings of the die and the corresponding surfaces of the punch must be ground to radii that are joined by curves of other radii or straight lines. The required contours are easily obtained by manipulating the handwheels of the rotary and regular tables of the milling machine.

### *Sharpening a Broach and Hand-Grinding Operations*

A portable precision grinder being used on a Lapointe broach-sharpening machine is shown in Fig. 7. The grinder is mounted on the swivel head of this machine for grinding successive teeth of a broach that is held on a magnetic chuck on the table of the machine.

Portable precision grinders are also being used as self-contained bench equipment for fine hand-grinding operations. The operation illustrated in Fig. 10 consists of finishing the chip clearance holes in a button die. As a bench machine, the portable precision grinder provides convenient equipment for the final hand-grinding operations that are often required along assembly lines.

* * *

It has been estimated that typewriters made with present-day perfection and costing $100 would cost nearly ten times that amount if they were produced with the machinery and methods in use when the first typewriters were built. Where would the typewriter industry be today, without modern machinery? And how much has machinery done, in this case alone, to increase employment?

## Switzerland Places Responsibility on Both Parties in Labor Disputes

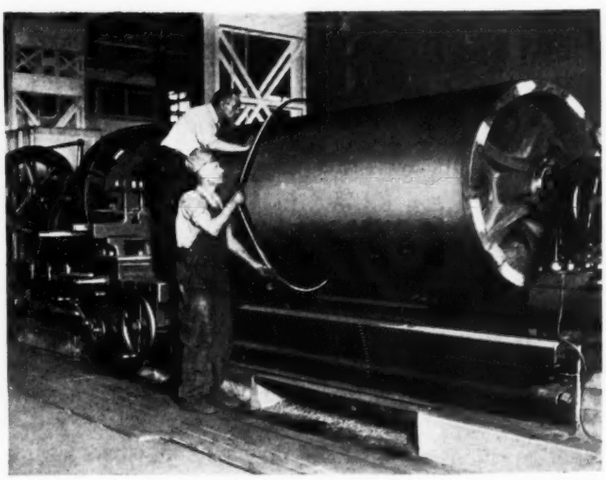
According to information furnished by Consul General A. C. Frost of Zurich, Switzerland, to the *World Machinery News*, published by the Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., an agreement providing for the amicable settlement and arbitration of labor disputes in the Swiss machine industry has recently been concluded between the Association of Swiss Machine and Metal Industries and the Metal Trade Unions. By this agreement, which covers two years, both manufacturers and organized labor have voluntarily agreed to abstain from lock-outs, strikes, or other similar measures during this period. For failure to observe this agreement, either party to the contract may be assessed a fine, thus making each definitely responsible.

* * *

## A Huge Drum Grooving Job

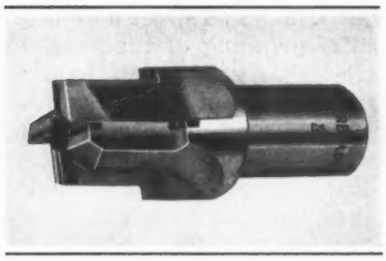
The illustration below shows the set-up for grooving a cable drum weighing almost 15 tons in the shops of the Harnischfeger Corporation, Milwaukee, Wis. The drum is made from semi-steel, and is 50 inches in diameter and nearly 15 feet long. When finished, it will handle a cable 1362 feet in length, and will operate on a crane with a maximum lifting height of 83 feet.

The drum is being built to handle the main hook on a 100-ton unloading trolley which will be installed in connection with the building of a large power development in the South. As is often the case in large water projects, the task of installing the huge generators and other equipment requires large overhead handling cranes; thus, in this case, the 100-ton crane will be installed for the sole purpose of aiding in the installation of a 300-ton crane, which, in turn, is to be used in the final installation of the generators.



*Grooving a Drum Weighing 15 Tons for a 100-ton Crane*

# Practice in Machining Zinc-Alloy Die-Castings



**Directions for Machining Die-Castings, Compiled by the New Jersey Zinc Co. on the Basis of Information Obtained from a Great Number of Plants where Die-Castings are Produced and Machined, and from Makers of the Required Tools and Equipment—Third of Six Articles**

THE preceding articles in this series, published in October and November MACHINERY, have dealt with drilling and tapping operations on zinc-alloy die-castings. The present article will deal with reaming and facing operations.

Next to drilling and tapping, reaming is one of the operations most frequently performed on zinc die-castings. Much work is done with reamers that are standard in most respects, although some special grinding is often desirable. The machine reamers commonly used have six straight flutes, but one manufacturer states that eight flutes, irregularly spaced, yield better results. A back taper of about 0.001 inch is generally used. Spiral flutes are sometimes recommended and are required, of course, for a hole with a keyway; a very marked spiral is considered essential if any is used.

One prominent die-caster reports best results, in the case of deep-hole reaming, with a reamer having left-hand spiral flutes, but cutting right hand. Deep flutes are recommended, and polished flutes have been found to avoid loading. One die-caster reports excellent results from chrome-plating the flutes of reamers after the flutes have been polished, the polishing and plating preventing loading. Rose reamers are not recommended.

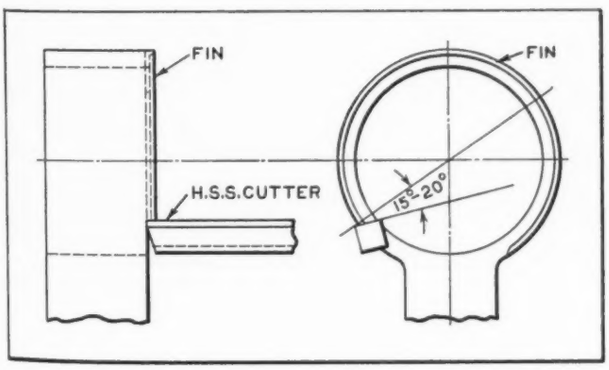



Fig. 11. Diagram Showing How the Cutting Face of the Cutter is Turned to an Angle of from 15 to 20 Degrees to Reduce the Size of the Facing Burr

An important consideration in successful reaming is to have the lands narrow and the cutting edge keen; some recommend stoning the edge. The face of the flutes is usually made radial, and the clearance angle back of the land generally approximates 10 degrees. Many standard reamers have a land that is too wide for best results in zinc alloys. A land about 0.015 inch wide is frequently recommended, but this is often ground down to around 0.007 inch or even 0.005 inch, resulting in freer cutting, less tendency to load, and reduced heating.

A wide land tends to produce burnishing and to generate heat. In one instance, on a 1 1/2-inch hole, a reamer with 0.005 inch land was found to give good results without heating. If heating is sufficient to cause the hole to expand, it may be found too small after the reamer has been removed and the piece cooled. A reamer with a 0.015-inch wide land or less sometimes cuts from 0.0002 to 0.0005 inch over size, but this depends in part upon the amount of metal removed, the amount of heat generated, the thickness of metal around the hole, and the way the reamer is ground. Some consider it better practice to let the work float than to fasten it solidly while reaming, but under certain conditions, this may not give best results.

### *When Stepped Reamers May be Advantageous*

If 1/32 inch or more metal is to be removed, it is sometimes recommended that the reamer be ground with a stepped portion at the end, about 0.005 inch smaller than the body of the reamer above the step. The step cuts away most of the metal, leaving the body portion to size the hole with a light cut, but one engineer considers this hard on the life of the reamer. The alternative recommended is to remove the entire amount of metal in one cut with a single-land reamer of correct design, using a feed per revolution such as to yield the desired finish. Stepped reamers are, of course, used for simultaneously reaming stepped holes.

Most of the cutting with a reamer is done by the ends of the flutes, which are beveled to provide a

lead, usually at about a 45-degree angle. Once the initial grinding of the flutes and lands is correct, little other grinding is required subsequently, except at the lead end, though in some cases, a very light cut may be taken off the radial face of the flutes. In grinding the lead, a clearance angle of about 10 degrees is advocated.

For holes of sufficient size to permit the use of inserted-blade reamers, this type is sometimes preferred. The inserted-blade reamer should be so designed and made as to hold the blades rigidly. In some cases, the blade can be shaped so as to perform a facing operation at the bottom of the hole, as well as to size the hole itself, although some do not consider this good practice. In certain instances, broaching, especially with broaches having burnishing lands, may yield a more accurate and a better finished hole than reaming.

### *Use of High-Speed Steel for Reamers*

In some shops, high-speed steel reamers are used exclusively. There are cases where over 30,000 holes have been sized by these reamers without resharpening, the holes being about 1 inch long and held within limits of 0.483 and 0.4845 inch, but much more frequent sharpening is usually required. For some high-production work, Carboloy-tipped inserted blades are employed to advantage. In one die-casting, a hole of 1.3335 inch diameter is reamed in this manner and is held within plus 0.001 and minus 0.000 limits. This reamer rotates at 640 revolutions per minute and the feed per revolution is 0.008 inch, a light spindle oil being used as a lubricant. The reamer is ground 0.0002 inch under the size of the hole. About 0.030 inch of metal on a side is removed.

As in other machining, the speed recommended for reaming varies considerably with the conditions. In one case, a standard reamer of 0.623 inch diameter running at 600 revolutions per minute gives good results.

Hand reaming can be done readily. One lathe manufacturer reports excellent results in reaming the holes in die-cast pulleys and gears, simply turning them by hand about a reamer held in a vise.

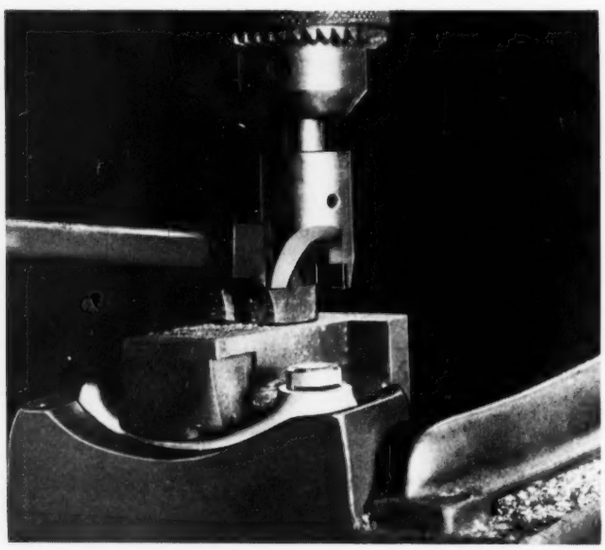


Fig. 12. Hollow-mill with Tungsten-carbide Inserts Facing and Sizing the Hub of a Die-cast Door Handle. About 1,200,000 Handles have been Machined without Resharpening the Tool

### *Facing Operations on Zinc-Alloy Die-Castings*

Another common operation on die-castings is the spot-facing of bosses, usually about a central hole. The facing tool, according to some engineers, should have an odd number of large teeth, usually a maximum of seven, with plenty of chip clearance between them. The tools sometimes have inserted carbide tips and can be arranged to cut on more than one level, if desired, as in the combination seating and spot-facing cutter shown at the top of page 231, especially for long runs. The faces of the teeth may be in radial planes, through the axis of the cutter—that is, without rake—but a clearance angle of about 12 degrees is often recommended. For large diameters, inserted-blade cutters are sometimes employed, and the cutters may have carbide inserts if desired. In spot-facing large work, a spring plunger is frequently used, when removing a heavy flash, to prevent the tool from pulling the work out of the fixture.

An intermittent surface may result in making any tool jump. In such cases, the tool should be held firmly against the surface and remain in contact with it long enough to insure a true facing.

One large user of die-castings has found it advantageous in some cases to turn the cutting face of the cutter through an angle of 15 or 20 degrees, as shown in Fig. 11, to reduce the size of the facing burr. If the fin is on the outer edge of the casting, the chips should be turned toward the center of the part being faced. This procedure has a tendency to shear the metal toward the solid portion of the casting. If the fin is on the inner edge, the metal should be sheared outward. This practice is suitable only where the fin is perpendicular to the surface and where it covers only a portion of the width of the surface being faced. The speed of facing depends on several factors. In one case, it is done efficiently on a 3 3/4-inch flange with the tool rotating at 600 revolutions per minute.

A lathe manufacturer reports good results in facing hubs of die-cast pulleys and gears in a lathe, using a hollow-mill. The hollow-mill can be arranged, if desired, to turn a cylindrical surface of a diameter equal to its bore, and at the same time perform a facing operation, as shown in Fig. 12.

Facing is often done in a lathe with ordinary lathe tools, especially if the casting is suitable for chucking. Facing can also be done on other machines with a fly cutter or a milling cutter.

Flat surfaces are often faced on belt sanders or against faceplates covered with sand or emery paper or against flat grinding wheels. Such grinding operations are usually rather rough, the casting ordinarily being held by hand.

# Some Typical Tungsten-Carbide Applications

*By*
FRANK W. CURTIS

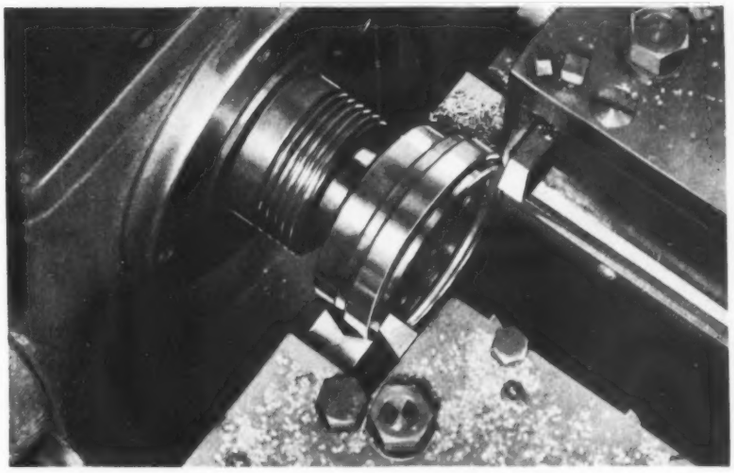


Fig. 1. Turning a Brass Ring at a Cutting Speed of 550 Feet per Minute with Tungsten-carbide Tools

SINTERED carbide tools are now so widely applied that it is difficult to speak of any applications as more typical than others. The examples referred to in this article are, however, so frequently met with that they may well be called "typical."

A brass-turning operation is shown in Fig. 1. The part is a brass ring used in automotive transmissions, set up in a Carbo lathe. The first operation (not illustrated) is the facing and boring of one side, the part being held in a three-jaw chuck. For the operation illustrated, the work is held by means of an expansion arbor. Five tools are used simultaneously for turning, facing, chamfering, and grooving. The amount of material removed is about 1/8 inch, and the cutting speed is 550 feet per minute. The feed per revolution is 0.010 inch; the production, 125 pieces per hour. The tools are tipped with an exceptionally hard grade of tungsten carbide.

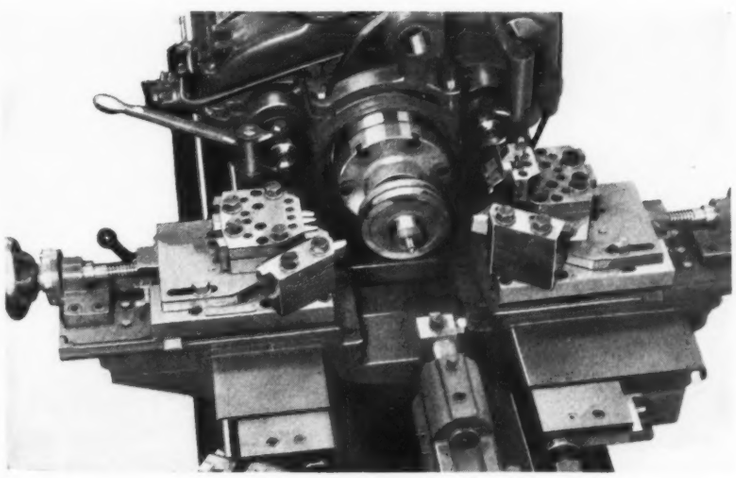


Fig. 2. Machining Cast-iron Pulleys with a Cutting Speed of 250 Feet per Minute

Another form of multiple-tool set-up for machining cast-iron pulleys in a Fastermatic lathe is shown in Fig. 2. In this case, many different sizes of pulleys are accommodated, varying from 4 to 7 1/2 inches in diameter, and having either single or double V-grooves. The tooling is more flexible than would be used for a single-purpose job, but in spite of tool changes, these pulleys are turned out exceptionally fast. Carbide tools are used throughout. The pulley shown is 7 1/2 inches in diameter, and is turned on the outside, faced, and grooved at a speed of 250 feet per minute, removing approximately 1/8 inch of material. The hub is also faced and turned while a set of formed tools in the rear tool-block form the radii on the webs of the pulley. Longer tool life, greater accuracy, and a better finish, in addition to increased output, are the results of using carbide tools. A grade of carbide of average hardness is used for the roughing tools, whereas for the grooving tools, which enter after the scale has been removed and cut with a light feed, it is possible to use a harder grade.

A set-up for the face-milling of cast-iron glass molds is shown in Fig. 3. A heavy-duty, vertical type Milwaukee machine is used, equipped with two heavy-duty fixtures, so that by reciprocating the table, one fixture is loaded while the other is in use. The cutter is 16 inches in diameter and operates at a speed of 200 feet per minute. This speed is suitable for this type of material, which is semi-chilled and fairly hard. The table feed used is from 14 to 17 inches per minute.

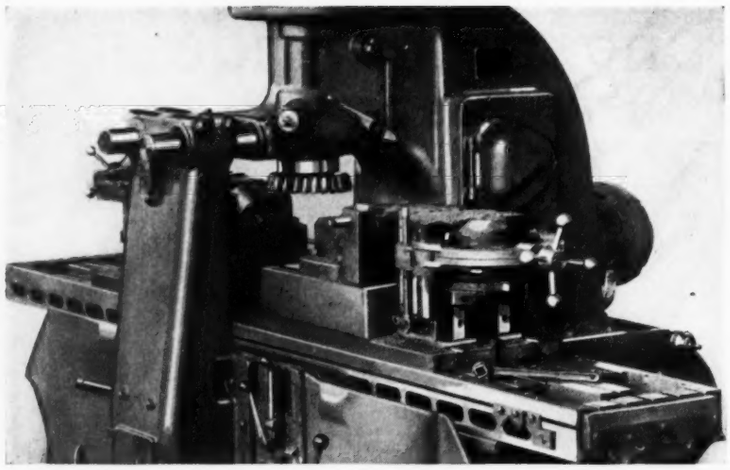


Fig. 3. Face-milling Cast-iron Glass Molds with a Cutting Speed of 200 Feet per Minute

A close-up view of the fixtures is shown in Fig. 4. They are of interchangeable design and accommodate a wide variety of molds. The part to be machined is placed in the fixture so that the joint face *A* is in line with the cutter. After the joint face has been machined, the mold is located at the end of the fixture in a vertical position so that the end surface *B* can be machined at the same pass. Prior to machining the molds with tungsten-carbide blades, it was necessary to finish-grind the joint faces, because smoothness was of importance. Now, with carbide cutters, grinding is eliminated, since the surface is milled to a satisfactory finish. The rate of metal removal is much faster than heretofore, and production has been greatly increased. The blades in the cutter are tipped with a carbide that is especially resistant to abrasive action.

* * *

Many people think of profits as the amount of cash that the owners put into their pockets each year. In most industries, a large part of the profits go back into the business for more buildings and more and better machinery to make new and better goods, all of which means more employment, greater production, a higher quality of goods or lower prices, or both. Reserves accumulated by well managed companies out of profits tend to stabilize employment and carry the organization through slack times. In the first three years of the depression, the corporations of the United States disbursed twenty-six billion dollars more than they received.—*Industrial Canada*

* * *

In 1902, there were 909 motor vehicles registered in the state of New York.

## Heat-Treating Form Tools Not Ground after Hardening

In many cases, form tools will give satisfactory service without the form being ground after hardening. It is important, however, that the heat-treatment be carefully carried out. The practice of one company is recorded in the following:

The form tools in most cases are made from bar stock; some are made from forgings. The steels used are the standard 18-4-1 type high-speed steel and, to some extent, the 18-4-2 type. The latter type is more difficult to heat-treat without surface defects.

The tools are first rough-machined to shape and thoroughly annealed. They are then finish-machined. Greater care must be taken in machining to the correct form than would be necessary if the tools were finished by grinding after hardening.

The tools are preheated in an electric furnace with a controlled gas atmosphere at a temperature of from 1500 to 1550 degrees F. They are held at this temperature just long enough to become thoroughly heated, and are then quickly transferred to a Globar type furnace provided with a curtain gas screen. Here they remain just long enough to reach a temperature of from 2350 to 2400 degrees F., after which they are quenched in oil. The temper is drawn for not less than one hour at 1050 degrees F. in an electric air type furnace.

When cold, the tools are finished by shot-blasting, using 24-mesh steel grit. During this operation, the blast is directed at a very slight angle to the tool—never at right angles. It is directed along the flat faces toward the sharp edges, so as to preserve and not blunt them. The top face of the tool is, of course, ground to the required angle. Tools made as described have proved exceptionally satisfactory in service.

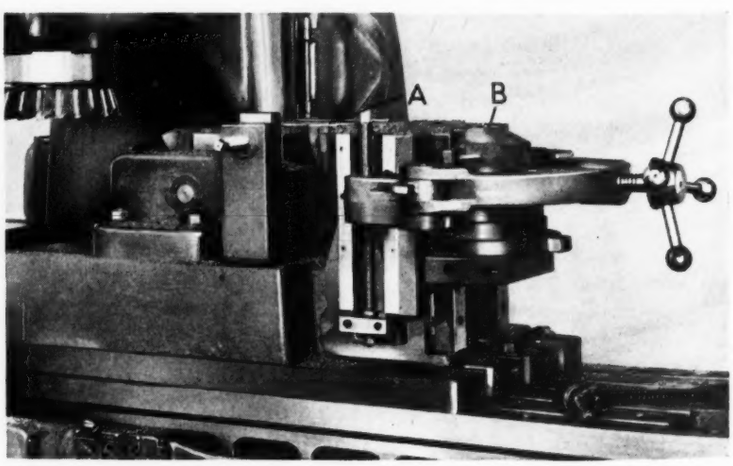



Fig. 4. A Close-up View of the Fixture Shown in Fig. 3, Showing how Work is Held

# The Hydraulic Operation of Machine Tools

**The Design of Valves for Controlling the Hydraulic Systems Applied to Machine Tools is an Important Factor in the Operation of These Systems—Sixth of a Series of Articles**

VARIOUS types of control valves employed by John Lund & Co., Ltd., on hydraulically operated machine tools are shown in Figs. 20 to 23, inclusive. A main control valve of a type suitable for a hydraulic surface grinding machine is shown in Fig. 20. This valve is of the sliding piston type, operated by oil supplied from an automatic reverse valve. The piston is provided with ports at opposite sides which connect with oil ducts machined diagonally in two plates at the top of the valve casing.

With the valve in the left-hand position, pressure oil entering at *P* follows the direction of the arrows along the piston port, up the vertical hole to the diagonal slot *A*, and across to *C* for the cylinder feed. The exhaust oil, coming from the opposite end of the table cylinder, enters at *D*, follows the direction indicated along slot *B* down the vertical hole to the piston port, and out to exhaust at *E*.

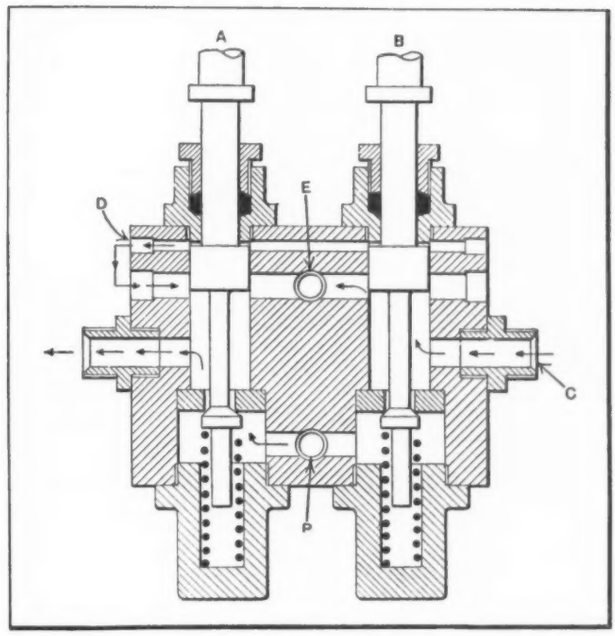



Fig. 21. Automatic Reverse Valve for Controlling Oil Supply to Valve Shown in Fig. 20

When the automatic reverse valve is actuated, the piston is moved across to the right, allowing the pressure oil to enter the piston port, pass to the right and up through bore *F* to slot *B*, and thence through *D* to provide the cylinder feed. Exhaust cylinder oil enters at *C*, passes along the slot *A* to the vertical hole *G*, and along the piston port to the exhaust *E*. The automatic reverse valve is connected by piping to holes in the end plates *H*, which are bolted to the main casing, together with the top plates in which the diagonal slots are formed.

A cross-section of the automatic reverse valve is shown in Fig. 21. This valve is bolted to the machine bed in such a position that the dogs on the traversing table can be set to depress the tappets *A* and *B* in turn. These are formed as conical valves at the lower end, being spring-supported, so that under

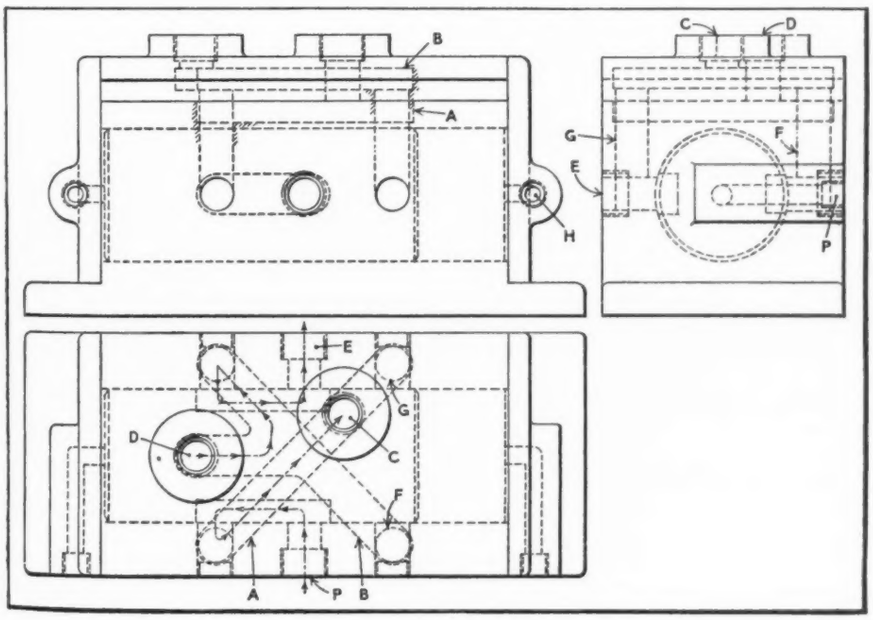



Fig. 20. Main Control Valve for a Hydraulic Surface Grinding Machine

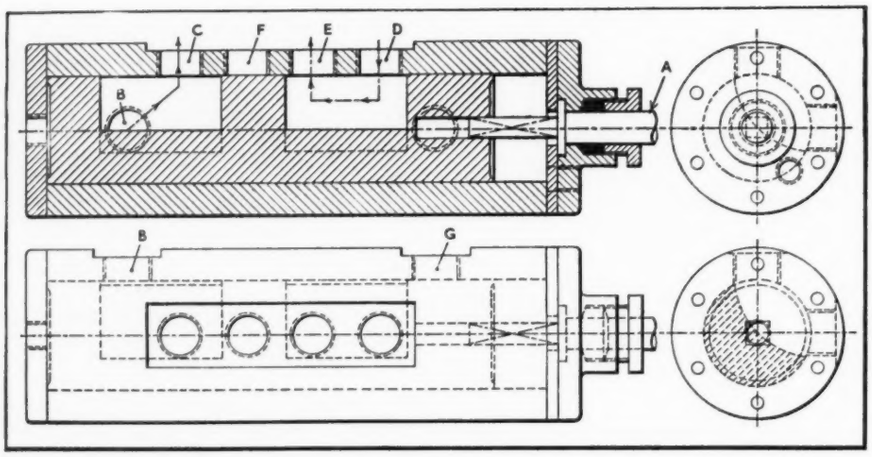



Fig. 22. Main Operating Valve for a Large Surface Grinder

The main operating valve for a large surface grinder, which comprises a circular casing carrying the piston, arranged to slide from end to end when operated by an automatic reverse valve of the type just described, is illustrated in Fig. 22. In addition to the sliding movement, the piston is arranged to be rotated by the speed control shaft *A*, which is formed with a square end and engages a similar hole in the piston.

Pressure oil from the pump enters at *B* and passes to the cylinders at *C*. The volume delivered is regulated by valve rotation, which, owing to the cut-away form of the port in the piston, partially closes the oil entry and slows down the table traverse as required, surplus oil from the pump passing through a relief valve back to the tank. The return oil from the cylinders is unaffected by speed control and simply passes through the port *D* to the exhaust *E* as indicated.

It will be observed that the ports *F* and *G* are closed at this stage; but as soon as the piston travels to the right, they are uncovered, while ports *B* and *E* are shut off. The pressure oil is now allowed to enter at *G*, and passes straight out at *D* for the forward feed, while return oil enters at *C* and exhausts at *F*. The lack of complicated oil ducts or pipe restrictions is a feature of this design.

non-operating conditions they are maintained in the top position against the valve seats.

The springs are assisted by pressure oil entering at *P*, until, assuming the left-hand tappet is depressed by a table dog, the oil follows the direction of the arrows and operates the piston in the main control valve, Fig. 20. The right-hand tappet, being unaffected, allows the oil driven out of the main control valve to enter at *C* and pass to the exhaust at *E*.

The same sequence of operations obtains when the opposite tappet is depressed on the table return. A relief duct *D* is connected to the exhaust bore, so that any oil leakage past the enlarged diameter of the tappet is free to escape instead of preventing the tappet from rising to its top position.

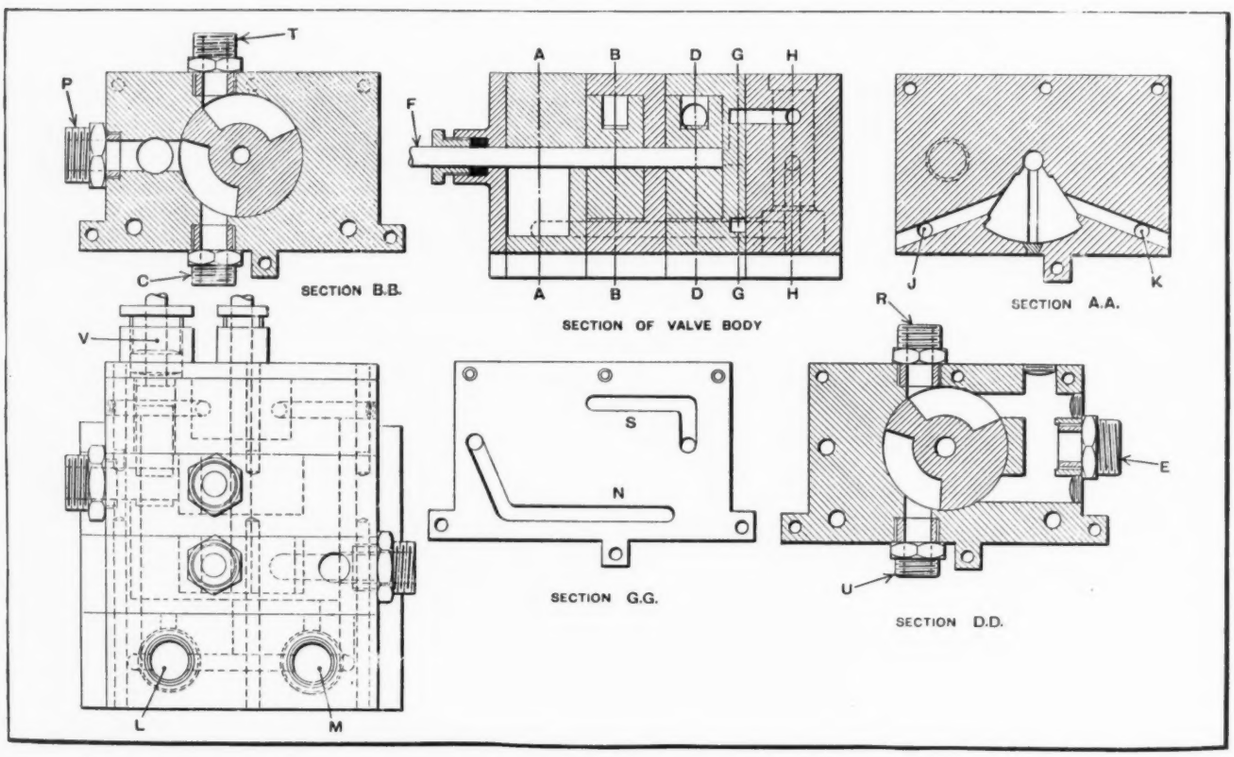



Fig. 23. Valve Gear that Provides for Variable Delivery, Hand and Automatic Reverse

An interesting arrangement of valve gear combined in one block to supply and exhaust oil from a cylinder with variable delivery, hand and automatic reverse, is illustrated in Fig. 23. Section *A–A* shows a swing valve connected to the control shaft *F*, which is given a partial rotation as the valve is driven from side to side by oil passing through ducts *J* and *K* as one or the other of two tappets *L* and *M* is depressed by movement of the table or slide. These tappets form part of an automatic reverse valve similar to the type previously described. The section *G–G* shows the slot *N* which is supplied with oil from the pressure port *P*, and the slot *S* which connects with the main exhaust port *E* as the swing-over valve changes position in its sector.

The section *B–B* shows the supply port *P* which receives oil from the pump, and, in the position in which the rotary valve is shown, passes the fluid forward to one end of the cylinder through the pressure port *C*. The returning oil from the opposite end enters at *R* and passes to the reservoir through exhaust port *E*. Alternatively with the change in position of the automatic reverse valve, the pressure and exhaust valves are partially rotated, closing ports *C* and *R* and opening *T* to pressure and *U* to exhaust. The control shaft *F* may be hand-operated if required; and by means of a screw-down valve *V*, the amount of pressure oil admitted at *P* can be regulated to vary the traverse.

* * *

## Swaging on a Riveting Machine

By ROBERT J. LONG

The resilient blow of the rubber-cushioned hickory-helve type of riveting hammer built by the High Speed Hammer Co., Rochester, N. Y., is as well adapted to many forms of swaging as to cold riveting, for which the machine is primarily designed. A cold swaging operation being performed on one of these machines is illustrated in Fig. 1. In this operation, a 3/8-inch rod is reduced to 0.300 inch diameter on each end for a length of 3/8 inch. The time required is four seconds per end. Fig. 2 shows at the top two of these rods as they come to the machine, and at the bottom, two rods that have been swaged.

The simple dies used for this swaging operation are so constructed that their flat faces come in contact with each other as the operation is completed, thereby sizing the ends of the rods. The operator rotates the work between successive strokes of the machine. For this operation, the ram-rotating belt of the machine is removed and the ram is locked against rotation.

This type of swaging is commonly employed for such parts as fire-escape ladders. After being swaged, the parts are invariably riveted into place in another operation that is also performed on High Speed hammers. For the riveting operations, the pein ram is rotated.

Fig. 1. Swaging Ends of Rods on a High Speed Hammer to the Shape Shown at Bottom of Fig. 2

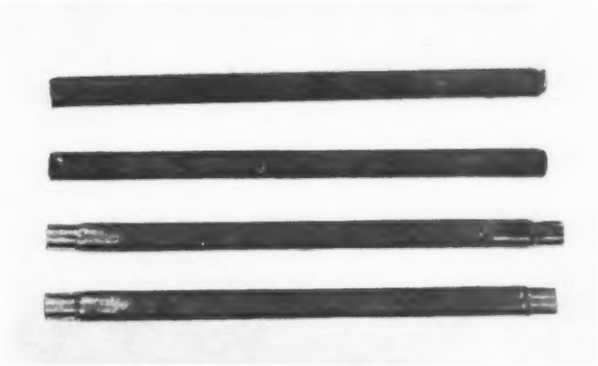


Fig. 2. Rods before and after the Swaging Operation Performed by the Machine Shown in Fig. 1

* * *

## Labor Information Bulletin

The Bureau of Labor Statistics, United States Department of Labor, Washington, D. C., publishes regularly a bulletin that contains a great deal of information relating to labor conditions throughout the United States. As an indication of the information contained in this bulletin may be mentioned some of the articles appearing in a recent number: "Recent Labor Legislation in Pennsylvania;" "State Labor Legislation Enacted in 1937;" "The 1937 International Labor Conference;" "Trend of Employment and Pay Rolls in Manufacturing Industries;" "Employment, Pay Rolls, Wages, and Hours in Selected Non-Manufacturing Industries;" "Review of Government Employment and Relief;" "Review of Business and Economic Conditions;" "Price Review;" and "Statistics on the Cost of Living."

# Engineering News Flashes

## *The World Over*

### A 6000-Horsepower Motor Car

The 6000-horsepower motor car with which Captain George Eyston, the designer, recently made a speed record of over 300 miles an hour, was built at the Bean factory, Tipton, England. This car is 36 feet long and is fitted with two Rolls-Royce engines, each developing 3000 horsepower. It has eight wheels, four at the front, arranged like the bogie on a railroad express engine, all of the wheels being connected with the steering wheel. At the rear end there are twin wheels, like those on large trucks and buses.

### A New Magnetic Inspection Device

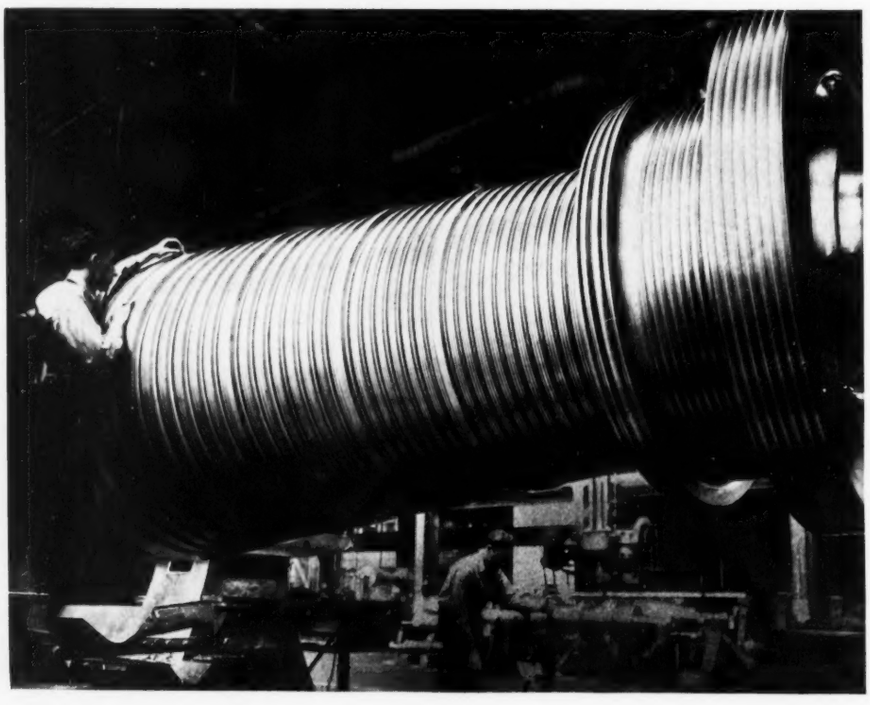
An improved method of inspecting machine parts for hidden flaws without destruction of the parts has been developed by the General Electric Co., Schenectady, N. Y. A constant magnetic field is produced, so that it penetrates through the entire thickness of a small area of the part to be inspected. The part is slowly revolved, in order to change continuously the section within the field, until the whole part is magnetically explored. Imperfections, such as blow-holes, hidden flaws, or non-homogeneous areas in the interior betray themselves by producing disturbances in the magnetic field at the surface of the inspected part, which are recorded by the testing instrument.

### Huge Airplane Propeller

A controllable-pitch propeller, suitable for airplane engines of about 1700 horsepower, is now being made by the British De Havilland Aircraft Co. This propeller is 14 feet 16 inches in diameter, and is claimed to be the largest ever made for aircraft purposes. It is being built for British airplanes.

### Steam Trains to Compete in Speed with Diesels

It has recently been announced that the Baltimore & Ohio Railroad is planning to build an engine capable of maintaining a speed of 100 miles an hour on level track when hauling fourteen Pullman cars. This engine, which will have sixteen cylinders, marks a radical departure from conventional design. The locomotive will have four pairs



Blading the Largest Single-piece Turbine Rotor Ever Made by the Westinghouse Electric & Mfg. Co. at the Company's South Philadelphia Plant. The Rotor, Made from Solid Forged Steel, is Over 20 Feet Long and About 5 1/2 Feet in Diameter. Thousands of Blades are Inserted in Circumferential Grooves Cut in the Surface of the Rotor. The Rotor will Make 1800 Revolutions per Minute, which Means that the Tips of the Blades will Travel at a Speed of Over 600 Miles an Hour

The Welded Framework of the Lincoln Electric Co.'s New Plant in Cleveland while under Construction. Structural Steel Weighing 1314 Tons is being Welded into One Rigid Frame to Provide a 200,000 Square Foot Addition to the Plant. The View Shows the Principal Bay, which is 240 Feet Long by 80 Feet Wide

of driving wheels, each pair being driven by a four-cylinder engine. Such an arrangement will greatly reduce the pounding of the track now experienced with the conventional high-speed locomotive. The new locomotive will weigh about 400,000 pounds, with 260,000 pounds on the drivers. The starting tractive power will be 72,500 pounds. It is expected that the cylinders will develop 5000 horsepower. The latest Diesel electric train of the Baltimore & Ohio Railroad develops 3600 horsepower in four twelve-cylinder Diesels.

## New Slab Mill Employs 5000-H. P. Individual Roll Motors

A new slab mill being built in the Pittsburgh district has a capacity for rolling slabs up to 60 inches wide from ingots weighing up to 45,000 pounds. The average rate of rolling is 250 tons per hour. Each roll will be driven by a 5000-horsepower Westinghouse reversing motor. The vertical edging roll will be driven by a 3000-horsepower motor.

## Automatic Bright Acid Dip Machine

What is believed to be the first successful large-size automatic bright dip machine was recently put in operation at the Belleville Base Works of the Westinghouse Electric & Mfg. Co., Belleville, N. J. After six years' experimentation, a fully automatic machine has been developed. This machine, which is about 40 feet long, completely glass enclosed, automatically dips baskets of brass shells in several successive acid dips, in a number of wash solutions, and in a lacquer-soap compound, delivering the work, bright-lacquered and dry, at the end of the machine. The acid concentrations are also automatically controlled. The capacity of the machine is 250,000 lamp bases an hour. The work turned out by the machine is much more uniform than that obtained by the manual process.

When hand-dipping, the operators wore rubber aprons, rubber boots, elbow-length rubber gloves, and goggles. They worked on acid-soaked duckboards. The acid baths often "went bad" without warning and the work had to be redipped. Now the operators of the automatic machine do not wear gloves, aprons, boots, nor goggles. They could dress in ordinary business suits if they wanted to. There are no splashing acid, fumes, or steam, and acid-proof flooring is no longer needed. The inventor and designer of the machine is F. A. Newcombe, factory engineer, who worked in collaboration with J. B. Whitemore, superintendent.

## Measuring the Thickness of Nickel Coatings

In general, the protective value of nickel coatings on either steel or brass, including those covered with the usual thin chromium layer, depends largely upon the thickness of the nickel. This has usually been specified in terms of the average thickness, but now a certain minimum thickness is often required.

Rapid methods of measuring the thickness at any point are therefore desirable. Most of the methods now used destroy the coating or the article. According to the *Journal of the Franklin Institute*, a non-destructive method for measuring the thickness of nickel coatings on metals such as brass and zinc has now been developed.

A small spring balance is used to measure the attraction between the nickel coating and a small permanent magnet. The thickness of the nickel is indicated by the reading of the dial, which is standardized against a similar nickel coating of known thickness. Before testing nickel coatings of unknown source, they should be annealed for a short time at 400 degrees C. (750 degrees F.).

# EDITORIAL COMMENT

Much has been said recently in the trade press on the necessity of training young men so that skilled mechanics will be available to maintain the supremacy of American machine-building industries. In many instances, this training has been undertaken with the definite purpose of creating not only skilled mechanics, but future foremen and shop executives. It will be quite a number of years, however, before the young men now starting on a course of training will be capable of filling such positions. In the meantime, the need for properly qualified foremen and shop executives is becoming more and more pressing.

## Training of Foremen, One of the Pressing Needs of the Day

The works manager of a large electrical company recently placed emphasis on the immediate need for the training of capable mechanics to become foremen. In many instances, there is also need for definite training of the men already acting as foremen, in order that their usefulness and effectiveness may be increased. "The first and fundamental principle in foremen training," said this works manager, "is to teach them to act as heads of their department rather than as bosses; to be truly leaders rather than order-givers."

## Management of Men is as Important as Machine Efficiency

The importance of having the foremen truly represent the firm and its policies is not sufficiently emphasized. Misunderstandings between employer and employes could often have been avoided had the foremen properly understood their job and given to their men a clear understanding of the firm's policies and activities. Obviously, the foremen cannot do this unless they, in turn, are properly informed by the management as to these policies. More emphasis has been placed in most of our large plants on efficiency in production than on efficiency in the management of men. At present, the importance of the latter is greater than ever.

Since the funds required to assure social security —old age and unemployment insurance—can be obtained in no other way than through the profits of industrial enterprises who pay the taxes that form the basis for such social security, it is obvious that social security cannot exist without business prosperity. Those who are honestly endeavoring to obtain for all workers freedom from want in their old age, and freedom from anxiety due to loss of their job, must also exert themselves to the full extent of their abilities in securing fair treatment for business and industrial enterprises. If industry does not thrive, social security is an idle dream. The more prosperous the business enterprises of the nation are, the greater and more permanent security can be provided for the nation's industrial workers.

## Social Security is Based on Industrial Prosperity

Those who undermine the sound financial conditions of business enterprises, either through unwise legislation, oppressive tax measures, or by condoning unfair and unlawful actions on the part of labor leaders, are also undermining the very security that they advocate.

Security in old age and security from ill effects of unemployment are the evidences of a well organized economic system in a civilized community. They can only be obtained in a community based on a common-sense economic procedure. Productive work and industrial progress are its safest—and only—guarantees. Whoever strikes a blow at business prosperity, activity, and enterprise, strikes a blow at social security.

It is only by a combination of increased manufacturing efficiency and equitable distribution of the products of industry and agriculture that a higher standard of living can be achieved. Permanently higher wages can only be paid if more goods are produced and consumed by a constantly larger number of people; and this greater production can be obtained only through greater manufacturing efficiency. These three factors—better equipment, production, and wages—are inseparable. The more thoroughly this fact is appreciated, the better for all engaged in industry.

## Better Equipment, More Production, and Higher Wages Go Together

# Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

## High-Speed Automatic Reversing Mechanism for Wire Guide on Winding Machine

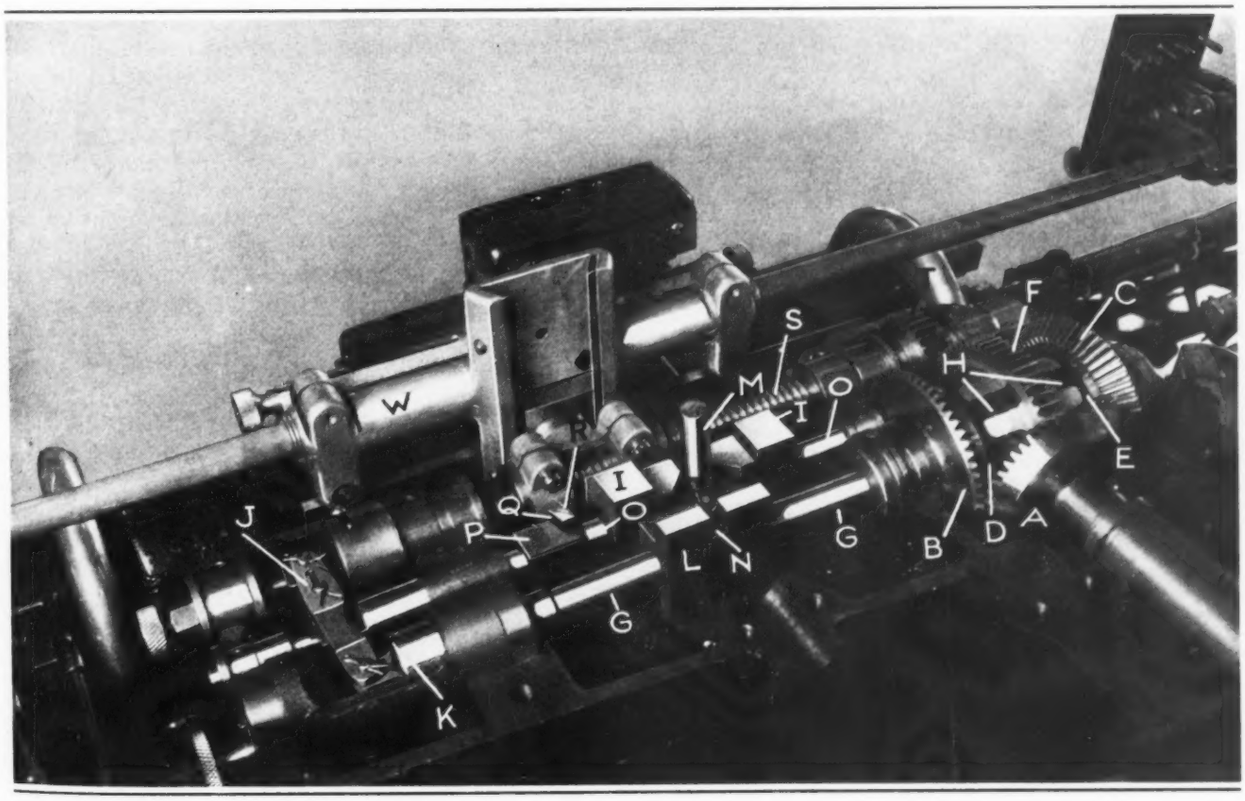
By ROBERT HOFSTETTER

The purpose of the mechanism shown in the accompanying illustration is to cause a quick reversal of the direction of travel of the bar *W* which carries a wire guide on a winding machine. The reversing action at each end of the traversing movement is brought about by a shifter dog alternately engaging the serrated sides of two ring gears which rotate constantly in opposite directions. Tensioning and releasing of the shifting device are accomplished automatically by the mechanism itself, so that once started, the reversing action will continue until the machine to which it is connected is stopped.

The main drive gear *A* rotates the secondary gears *B* and *C* continuously. Fastened to gears *B* and *C* are two serrated ring gears *D* and *E*. The center gear *F* is mounted on a hollow shaft *G* and carries, near its periphery, the shifter dog *H*. This dog cannot assume a neutral position, but is always in engagement with either ring gear *D* or *E*, depending upon which compression spring in tension block *I* acts on the push-rod *K* through the rod *O* and link *J*. The action of the spring in block *I* is transmitted to the shifter dog *H* through hollow shaft *G*. A special nut *L*, fitted over a threaded portion of shaft *G*, reverses its longitudinal movement whenever the center gear *F* changes its direction of rotation.

Nut *L*, in moving to and fro, imparts to lever *M* a motion that is limited by the camming-out action of slot *N* in nut *L*. The fulcrum bearing of lever *M* is located in the cover of the mechanism, which has been removed to give an unobstructed view. The forward end of lever *M* engages tension block *I*.

Rod *O* passes lengthwise through tension block *I* and has fastened to it a collar which is a loose fit in the bore of the tension block. On each side of the collar are two springs, which are held under tension by plugs, screwed into the end of the ten-




Mechanism for Automatically Reversing Direction of Travel of Guide on Wire-winding Machine

sion block; the plugs are bored out to give rod *O* proper clearance. Fastened to rod *O* is a trip-block *P* with suitably shaped and hardened surfaces *Q* and *R*. Two trip-dogs mounted on fulcrum studs in the same cover as lever *M* rest against surfaces *Q* and *R*. These dogs are alternately tripped by the bar that carries the wire guide as it arrives at the end of its stroke.

The bar that carries the wire guide receives its reciprocating motion through lead-screw *S*, which is driven by pinion *T*. Pinion *T* is in mesh with the center gear *F*. In operation, the guide wire bar has been made to reverse in approximately one-eightieth of a second, while under test conditions, less than one-hundredth of a second is required to accomplish a reversal.

## Lever-Operated Self-Locking Indexing Mechanism

By GERRY B. NUTTING

One continuous motion of lever *C* of the mechanism shown in the accompanying illustration serves to index shaft *A* through angle *T* and lock it in position. This mechanism was designed by the writer about fourteen years ago and is still in use. It is employed on a hand miller in making two saw cuts in a steel arm. There are various sizes of arms and the angle between the cuts varies with the size of the arm. Provision is made for adjusting the indexing plates *S* and *R* to suit any required indexing angle *T*.

Shaft *A* is part of the work-holding cradle of the fixture, which is to be indexed and locked in either of two positions. Arm *B* is pinned to shaft *A*. The stud *D* is held in arm *B* by nut *E*. The operating lever *C* and pawl *F* are free to swing on stud *D*, being retained on the stud by a washer and nut *G*.

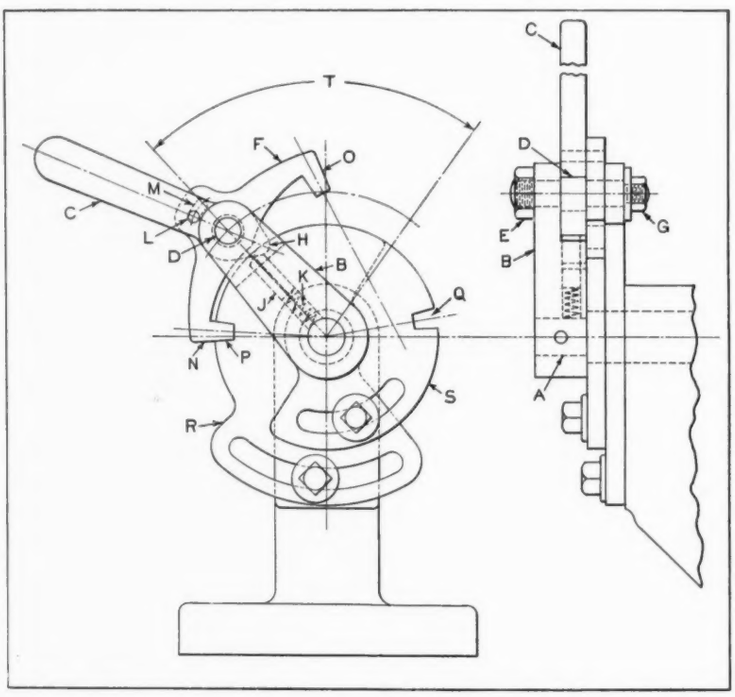
The end *H* of lever *C* terminates in a point formed to a small radius. This pointed end engages a pointed plunger *J* which slides in a hole in the arm *B* and is forced against the pointed end of lever *C* by helical spring *K*. The action of the spring plunger against the operating lever *C* causes the lever to turn away from the plunger when the lever is swung to either side.

A pin *L* driven into a hole in lever *C* slides in a slot *M* in the pawl *F*. The length of the slot is such that the lever can be swung until its point snaps over the plunger before the pin reaches the end of the slot and turns the pawl *F*. The pawl projections *N* and *O* engage the slots *P* and *Q*, respectively, in the index-plates *R* and *S*.

With the members of the mechanism in the position shown, the pressure of the plunger *J* against point *H* of lever *C* causes the lever to turn counter-clockwise. The pin *L* is thus brought against the end of slot *M* in pawl *F*, turning the pawl and forcing projection *N* into slot *P* in the index-plate.

To be indexed to the other position, the lever *C* is turned clockwise until its point *H* snaps over the point of the plunger *J* and the pin *L* has moved to the other end of slot *M* in pawl *F*. The pressure of the spring plunger *J* on lever *C* now holds pin *L* against the end of slot *M*. The projection *N* of the pawl will be withdrawn from slot *P* and the pawl will be rotated clockwise until its projection *O* comes in contact with the edge of the index-plate *S*. Continued rotation of lever *C* causes arm *B* and shaft *A*, with its cradle, to be rotated through angle *T*, the pawl projection *O* sliding on the edge of the index-plate *S*.

When projection *O* reaches slot *Q*, the spring plunger forces the pawl projection into the slot, thus completing the indexing operation. The reverse indexing is effected in the same manner by moving the lever counter-clockwise.

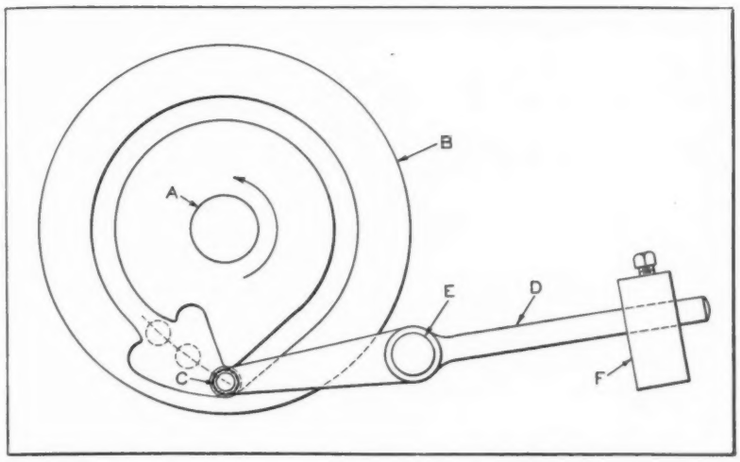



Two-position Indexing Mechanism for Milling Machine

## Cam Mechanism Designed to Control Shaft Speed

By L. KASPER

A shaft on a wire-forming machine must occasionally be rotated by a hand-crank. Owing to the nature of the product, it is necessary at one point in the cycle that the shaft be rotated at a predetermined speed. A speed that is either too fast or too slow results in defective work, although a fairly wide range is permissible between the maximum and minimum speeds. The accom-




Cam Arrangement for Controlling Speed of Shaft Driven by Hand-crank

panying illustration shows how a cam is used to maintain the speed within the required range.

Shaft *A*, which is rotated by a hand-crank in the direction indicated by the arrow, carries the cam *B*. The cam roller *C* is carried on the end of the lever *D* which fulcrums on the stud *E* on a stationary part of the machine. The adjustable weight *F* holds roller *C* in contact with the inner cam surfaces.

In operation, if the speed of rotation of shaft *A* is within the required range, the roller *C* will follow approximately the path shown by the dotted circles. If the speed of rotation is too high, roller *C* will have insufficient time to follow its normal path and will lock in the pocket of the outer cam surface. If the speed of rotation is too low, roller *C* will roll down the sharp incline on the inner cam surface and become locked in the inner pocket. In either case, the cam roller must be returned to its normal path before further rotation is possible. The position of weight *F* is determined by experiment.

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## Mechanism for Reversing Work and Transferring it to Another Spindle

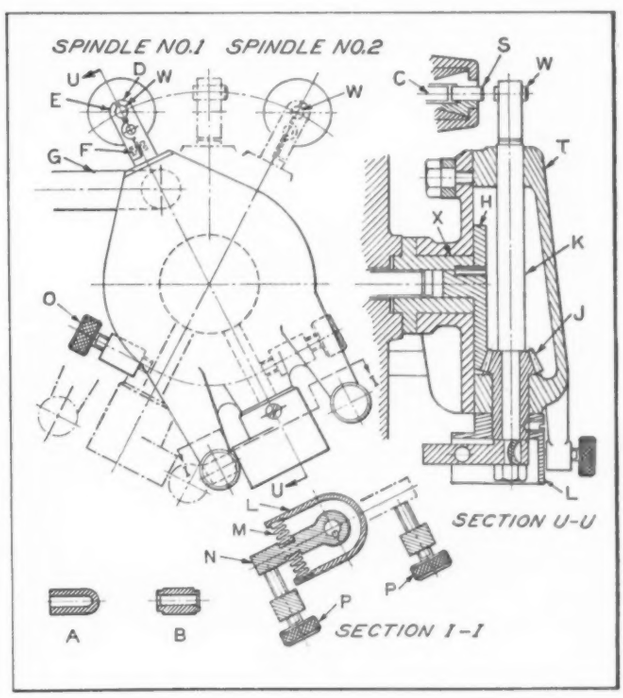
By T. GETAZ

The purpose of the mechanism shown in the accompanying illustration is to transfer the work *W* from spindle No. 1 of an automatic machine to spindle No. 2, and at the same time, reverse the position of the work, so that the chamfered end *S* is inserted in the chuck of the second spindle. The particular set-up shown is used in machining drawn shells such as shown at *A* to the form shown at *B*.

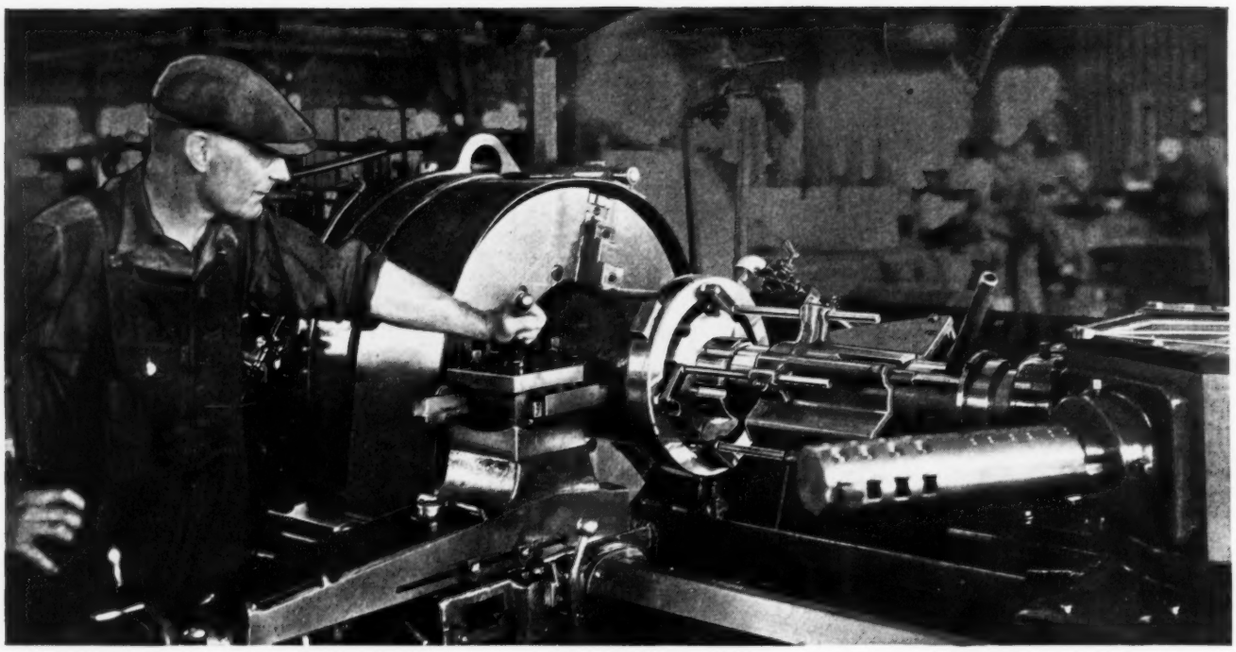
After the work has been chamfered, as shown at *S*, the housing *T* of the transfer arm is swung or rotated on its supporting bearing *X* to bring the jaws *D* and *E* in line with spindle No. 1. Rod *C* then pushes the work into place between jaws *D* and *E*. The housing *T* is next rotated or indexed on its bearing *X* to bring the work into line with the chuck on spindle No. 2. During this transfer movement, the shaft *K* is rotated 180 degrees, so that the chamfered end *S* is in the required position to enter the chuck on spindle No. 2 when the work is pushed from between the jaws *D* and *E* and into the chuck.

Referring to the illustration, spring *F* exerts sufficient pressure on jaws *D* and *E* to cause them to hold the work securely while it is being transferred from one position to the other. The housing *T* is indexed about bearing *X* by means of link *G* which moves forward or backward at the proper time.

The rotation of shaft *K* for reversing the position of the work is accomplished by means of the stationary segment bevel gear *H*, which is in mesh with bevel pinion *J*. To pinion *J* is secured a member *L* which transmits the required turning movement to shaft *K* through springs *M* and the arm *N* secured to the end of shaft *K*. The rotating movement of shaft *K* is stopped at each spindle position by stops *P*, which can be so adjusted that the work is revolved exactly 180 degrees while being transferred from one spindle position to the other. In the stopped position of arm *N*, the spring *M* which transmitted the motion to the arm is under sufficient pressure to keep the arm in contact with the stop. Stops *O* which limit the indexing movement of housing *T* are adjusted to bring the work into accurate alignment with the spindle.




Mechanism for Automatically Reversing Position of Work W and Transferring it from One Spindle to Another



# Modern Machine Tools in the Oil Industry

By CHARLES O. HERB

**Threading Operations on Pipe Couplings and Other Parts, and Accurate Inspection Methods—Second of Two Articles**

THE machining of sucker rods and pipe couplings, such as are used in the oil industry, was described in an article published in November MACHINERY. The operations were performed on automatic screw machines, a vertical turret lathe, and a Bullard Mult-Au-Matic. Typical threading operations in the same industry and several gages employed for thread inspection will be described in the following.

### *Threading and Cutting with a Large Collapsible Tap and a Receding-Chaser Die-Head*

The heading illustration shows a 10 3/4-inch float collar being tapped on a turret lathe equipped with a receding-chaser collapsible tap made by the Landis Machine Co., Waynesboro, Pa. This float collar is made of Grade C seamless-steel tubing with a thread 9 inches long in one end. There are 8 threads per inch, and the taper is 3/4 inch per foot. The actual tapping time for cutting this unusually long thread is 9 minutes. Other cuts are taken on the same turret lathe to prepare the part for tapping.

The operation shown in Fig. 1 consists of threading oil-well casing 8 1/8 inches outside diameter in a machine built by the Landis Machine Co., which is equipped with a large receding-chaser die-head. The photograph was taken in a typical oil-field shop, where casing and other tubular parts are rethreaded when the threads have become worn. Normally, the operation involves first cutting off the old thread and preparing the casing for a new thread. On 8 1/8-inch casing, the threads are cut 10 per inch, with a taper of 3/8 inch per foot, and to a length of 3 5/8 inches. The floor-to-floor time on casing of this size, including cutting off, beveling, reaming, and threading, is 10 1/2 minutes.

### *Milling and Threading Steel Castings on a Planetary Machine*

Cast- or forged-steel return headers that are made singly or in any number up to six are form-milled in one end of each bore and thread-milled in the other end by a machine recently built by the Hall Planetary Co., Philadelphia, Pa. Threads of Acme or U. S. form, from 3 to 8 inches in diameter, are cut in these heads. One of the largest six-

*Fig. 1. Threading 8 1/8-inch Pipe Casing in a Machine Equipped with a Large Receding-chaser Die-head*

head castings weighs about 800 pounds, which obviously makes it impracticable to revolve the piece for either boring or threading.

The work is placed, as shown in Fig. 2, on the hardened and ground ways of the Planetary machine, and slipped into approximate alignment with a hydraulically operated tailstock ram. When the ram advances, it centers the end of the work that is to be machined, in a ring which surrounds the bore-milling or thread-milling cutter, as may be clearly seen in Fig. 3. Little power is required for the centering, as the work is counterbalanced by weights suspended at the front of the machine. Accurate chucking of each bore in relation to the cutter-spindle in a way that insures concentricity with the center line of the work is accomplished in about twenty seconds. The centering ring also serves the purpose of protecting the operator against injury from the revolving cutter.

As soon as the work has been chucked, cutting coolant starts flowing through the hollow spindle at the rate of 100 gallons a minute. All chips are washed off the cutter by the pressure exerted by this flow of coolant, and both the cutter and work remain cool in spite of the large amount of metal removed in a short period of time. For instance, 6-inch diameter threads to a depth of 2 1/2 inches are milled in from 3 to 4 minutes.

In milling the plain bore in the opposite end of these return headers to receive a tube, a form-milling cutter is substituted for the thread-milling cutter. Changing of cutters involves only a few minutes.

Five different parts are made from chromium-

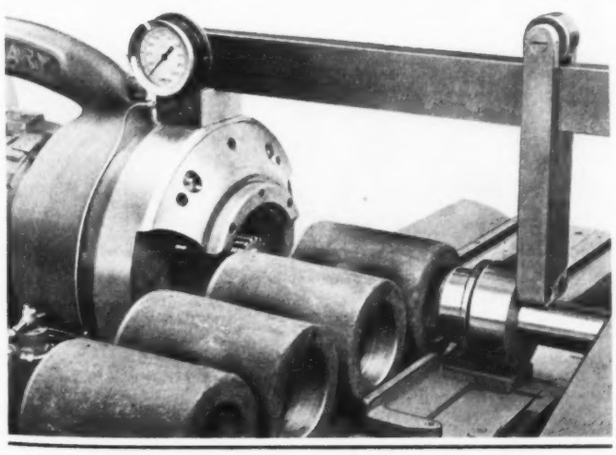


*Fig. 2. Cast-steel Return Headers Made Singly or in Multiples up to Six are Form-milled in One End of Each Bore and Thread-milled in the Opposite End in a Planetary Machine*

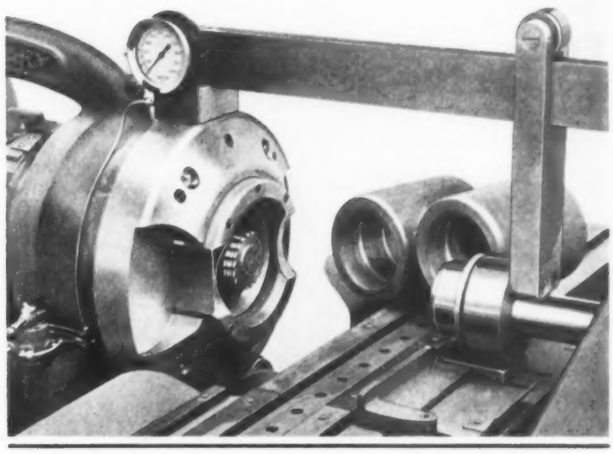


*Fig. 3. A Hydraulically Actuated Ram and a Ring that Surrounds the Cutter Provide for the Accurate Location of Each Casting Handled by the Planetary Machine*

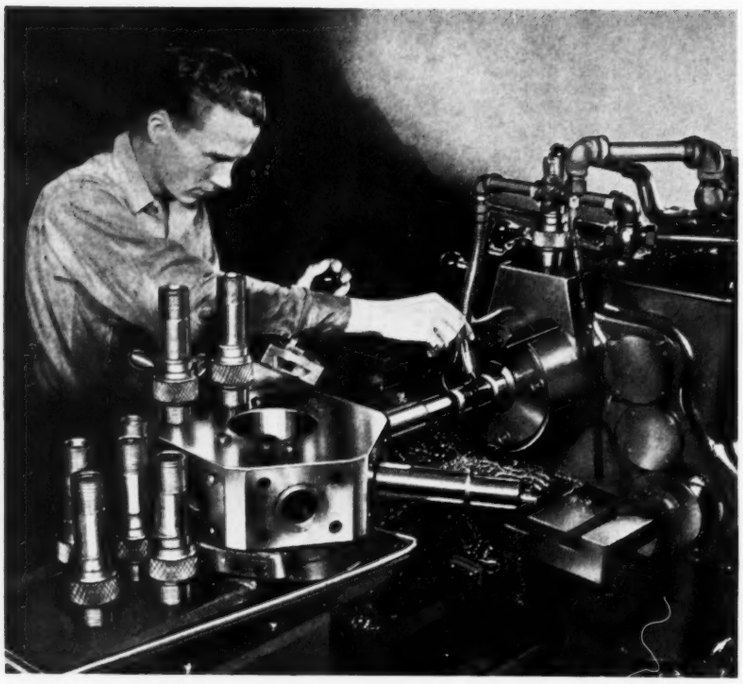


*Fig. 4. Turret Lathe Equipped for Machining Five Different Oil-pump Parts from Bar and Tubular Stock*

nickel-steel bar and tubular stock by the Gisholt ram type turret lathe illustrated in Fig. 4. The parts are all used in oil-pumps made by a Texas manufacturer, and range from 2 1/2 to 7 inches in length. The maximum diameter of the parts is from 1 9/16 to 2 5/16 inches.

The operation illustrated is the second one performed on the pieces seen on the turret and on the turret-slide. In the first operation, a 1 1/8-inch hole is drilled the full length by a drill on the turret, and at the same time, the piece is turned on one end by a toolpost tool. Then the piece is counterbored from the turret and threaded by a die-head, which is also mounted on the turret. The piece is finally cut off from the bar stock by a toolpost tool.

In the second operation—the one illustrated—the piece is chucked on the threaded end. The first step consists of counterboring the opposite end with a turret tool and turning the same end for a thread. Then the turret is indexed and the piece is threaded by means of the die-head. The total time for producing the piece is 8 minutes, whereas by a method formerly used, the time was 1 hour. Similar savings in time were effected in the production of the other four pieces.

The threading of sucker rods in a turret lathe equipped with a Landmatic 1 1/4-inch die-head is illustrated in Fig. 7. The rods handled by this machine usually come in 20-foot lengths and are inserted in the machine through the hollow headstock spindle. Close tolerances and a smooth finish are specified to insure a tight fit in the couplings that join these rods in lengths up to several thousand feet.

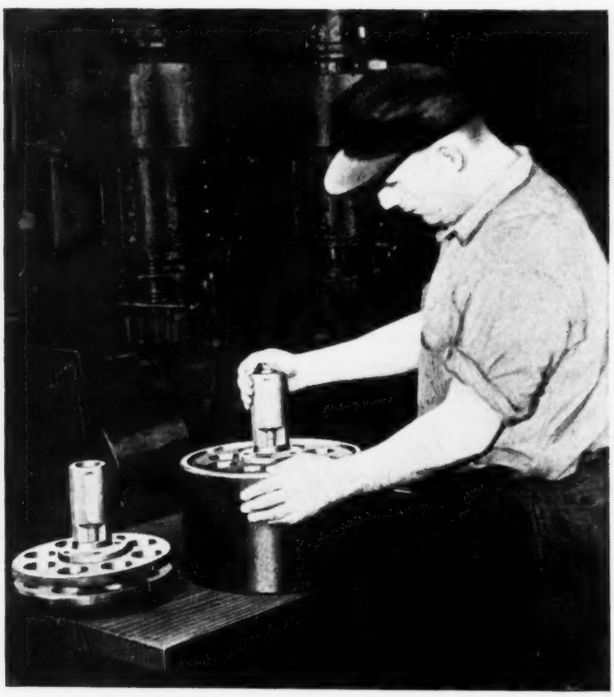


*Fig. 5. A Thread Gage of Double-plug Design being Used to Check the Taper of Pipe Coupling Threads*

*Fig. 6. A Plug Gage of Segmental Design which is Used for Determining the Draw of Coupling Threads*

### *Gages Used in the Oil Fields*

If a tool joint should loosen and come apart far under ground during the drilling of an oil well, great difficulties would be encountered in recovering the detached length of drill pipe and the drilling tool, and much money and time would be lost. This is one reason why it is essential to have accurate threads on tool joints. Gages for the inspection of tool-joint threads are made in both ring and plug types by the Pratt & Whitney Co., Hartford, Conn. This concern made a set of grand master tool-joint gages and several sets of regional master gages for the American Petroleum Institute which have been deposited at the United States Bureau of Standards. All regional master gages must interchange with the grand masters and all manufacturers' reference master gages must interchange with the regional or grand master gages. Working gages for individual manufacturers must interchange with the reference master gages.

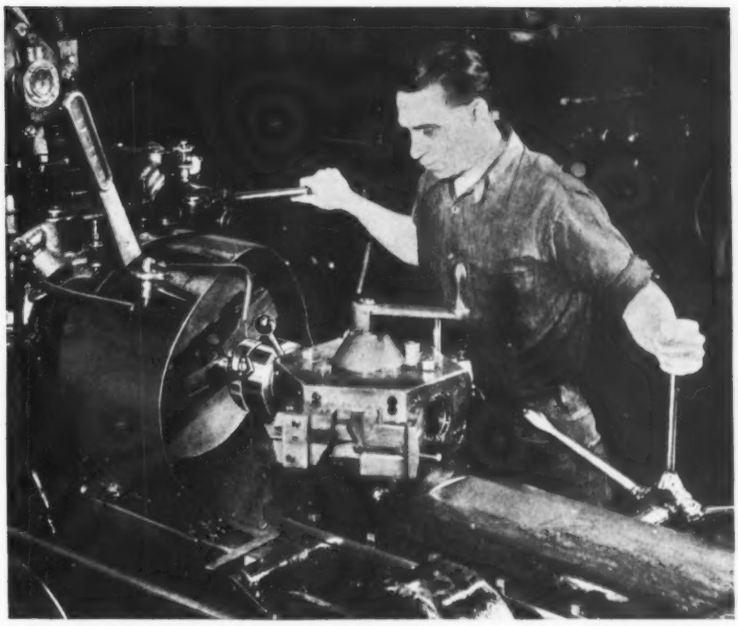


*Fig. 7. Threading the Ends of Sucker Rods in a Turret Lathe Equipped with a Die-head*

In addition to the tool-joint gages, the same company makes lines of gages for sucker rods, drill pipe, casing, etc. A double plug gage being used to check the taper in each end of a casing coupling is illustrated in Fig. 5. This gage gives a direct reading of any variation from the true taper and guards against the casing coming apart under ground, thus minimizing difficulties with leaking joints. Fig. 6 shows the application of a plug type thread gage for checking the amount of draw in a coupling, an important factor in obtaining a strong pipe joint.

* * *

## Hardness of Lathe Beds

By C. G. WILLIAMS, Consulting Engineer
American Cutting Alloys, Inc.

The writer would like to make some comments with relation to the article "Hardness of Lathe Beds" which appeared on page 32 of September MACHINERY. It is mentioned that cast iron with a hardness of approximately 400 Brinell, or 55 scleroscope, can be machined without grinding, although machining rates at this hardness will be extremely slow. It is also mentioned that roll makers are accustomed to handling their products at this hardness level and machining rolls without grinding.

The point the writer would like to make is that by the recently developed carbide tools the machining of chilled cast-iron rolls has been greatly facilitated. While in the past, rolls having a hardness of from 400 to 450 Brinell have been turned at a surface speed of 1 foot per minute, in recent tests such rolls were turned on an engine lathe at a speed of 25 feet per minute with Cutanit cemented-carbide tools. The roll was 12 inches in diameter, the cut 1/8 inch deep, and the feed 1/8 inch per revolution. The tool was so shaped, however, that the chip was actually 1 1/2 inches wide and curled up like a steel chip.

Another thought that comes to the writer's mind is this: Engineers still seem to have the idea that a very hard iron provides the best wearing surface, but this is not always so. Alloy irons with a hardness of not over 200 Brinell may have a far better wearing surface than a very hard iron because of the fact that any particles removed through wear are broken up so completely that they may be removed in the lubricant, while particles of very hard iron do not break up as easily, but form an abrasive which cuts and creates further wear.

* * *

## British Machine Tool Exports and Imports

According to information published by the Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., British machine tool exports in 1936 amounted to slightly over $10,000,000, a 12 per cent decrease from 1935, but a 20 per cent increase, compared with 1934.

The imports of machine tools were valued at $18,000,000 in 1936, compared with $8,500,000 in 1935, and $7,000,000 in 1934. The United States accounted for some 60 per cent of the imports, Germany for somewhat over 20 per cent, and Switzerland for 5 per cent. It is stated that deliveries of British-built machine tools vary from six to twenty-two months.

# Gaging Equipment in Modern Industry

## Importance of Proper Gaging Equipment with Special Reference to Gages Making Use of Electrical Contacts

By A. H. d'ARCAMBAL
Consulting Metallurgist
Pratt & Whitney
Division Niles-Bement-Pond Co.
Hartford, Conn.

Fig. 1. Electrolimit Gages Used by Machine Operator for Controlling Accuracy of External and Internal Dimensions, Concentricity, and Squareness of Roller Elements in Electric Refrigerator Manufacture

A PROMINENT gage authority offers this definition for "gage": "A gage is a device to improve quality, facilitate production, and reduce cost." This modern definition for gages is now commonly accepted by industry; the old idea that gages just added so much to the cost of production has passed. The American Gage Design Committee, made up of government representatives, gage users, and gage manufacturers, has since its formation some ten years ago, effected a standardization program that has proved of benefit both to the user and to the manufacturer of gages. Cylindrical plugs and rings, threaded plugs and rings, adjustable limit snap gages —all of improved design—have been standardized by this committee and are designated as A.G.D. gages. This is a splendid achievement, especially invaluable during an emergency, because of the interchangeability of gaging members, handles, etc. American gage manufacturers now work to the A.G.D. specifications for the types of gages mentioned. The general closing in of tolerances has resulted in an unprecedented demand for gages. Many new and efficient types of gaging equipment have been introduced during the last few years. A large number of industrial plants employ an experienced gage engineer who has complete charge of all gaging equipment, methods, and gage repairs. Close cooperation between the gage manufacturers and these gage supervisors results in the development of efficient gages that will check the work accurately and rapidly. Other requirements of a satisfactory gage are stability (permanence) and durability.

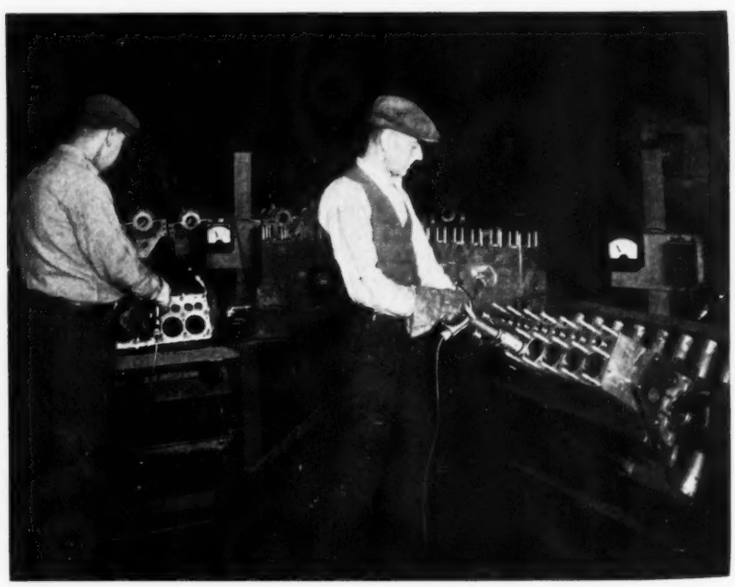


Fig. 2. Electrolimit Bore Gage Classifying Bore Diameters for Selective Assembly with Similarly Graded Pistons

Large manufacturing concerns, realizing the importance of proper gaging practice as affecting the quality and cost of their product, give the same consideration to gaging equipment purchases in their yearly budget set-up as to proposed machine tool purchases and other necessary tooling expense. The fact that, through the proper use of modern gages, a quality product at a minimum cost is assured, warrants this equal consideration of gaging equipment.

Mechanical and electrical comparators are now widely used by industry. Important parts of electric refrigerator units are manufactured to extremely close tolerances, comparators for accurately checking these parts being used both by the machine operators and the inspectors who check the finished product. Fig. 1 illustrates the use of electrolimit comparators for accurately measuring external and internal dimensions of refrigerator unit parts during the manufacturing process. Similar electrolimit comparators are employed in the inspection department. The electrolimit gage combines mechanical gaging with electrical magnification to obtain external and internal measurements. This gage uses a simple balanced bridge circuit, arranged so that any mechanical movement of the gaging points unbalances the magnetic field of the coils, the reading being shown on the micro-ammeter.

The electrolimit gage is a rugged instrument, working equally well in the machine shop or in the inspection department. The degree of magnification is easily adjusted, magnifications of 20,000 to 1 being used where such accuracy is essential, as in the case of checking precision gage-blocks within a few millionths of an inch. The indicating instrument or micro-ammeter can be located at any convenient position.

The automotive industry has taken full advantage of new gaging equipment to facilitate manufacture and at the same time improve the quality of its product. With electrical gages properly designed for each operation, pistons and cylinder bores, as well as wrist-pins and other parts, are accurately graded for selective assembly. Better fits at lower costs, producing quieter and longer-lived engines, have resulted from the use of these modern gages.

### *The Use of Electrolimit Gages in the Rolling of Sheet Metal*

The rapidly expanding use of tin plate, strip, and sheet steel has called for increased accuracy and greater efficiency in rolling mill operation, with resultant reduced costs. These conditions are similar when materials other than steel are rolled in strip and sheet form. Three types of gages have been responsible for reducing the operating cost of producing strip steel by permitting higher speeds on the mills, with increased accuracy, greater efficiency in mill operation, and increased efficiency in inspection through the continuous classification of the sheared sheets.

The continuous electrolimit gage employs a combination of mechanical gaging contact and electrical magnification. The gaging rolls control the electrical circuit in such a manner that errors in the material being checked are revealed in a greatly magnified and visible form on a micro-ammeter, which can be located at any desired point remote from the gaging unit.

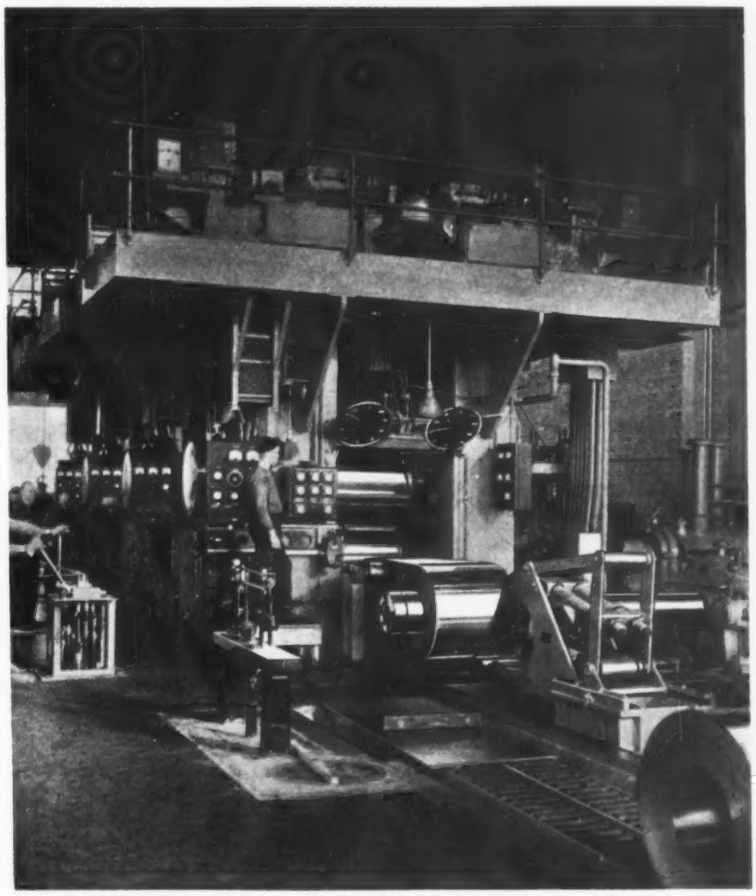
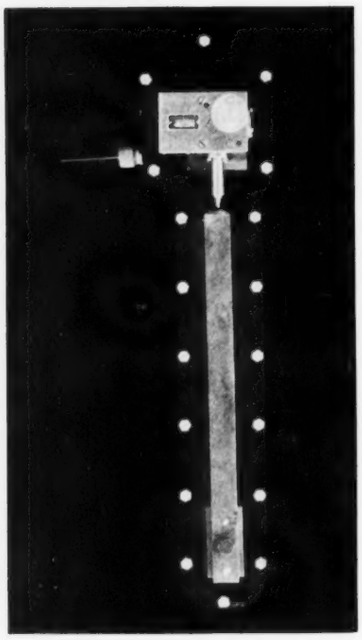
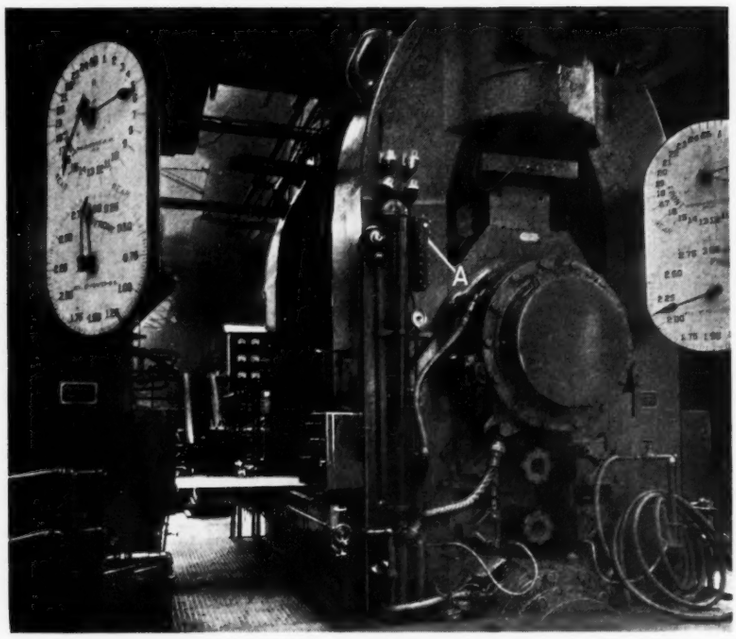


Fig. 3. A Continuous Electrolimit Gage Applied to a Cold Strip Mill

Electrolimit gages as applied to cold reduction mills permit accurate gaging of strip at speeds up to 1500 feet per minute. Some strip tin mills are holding their gage tolerance at $\pm$ 0.00025 inch at such speeds. Fig. 3 shows the gages applied to a cold strip mill. It can be observed that arms provide the linkage of the gaging unit with the cross-slide, and they are so designed and mounted that the gage will follow the strip and keep the gaging rolls in a perpendicular position






Figs. 4 and 5. The Pratt & Whitney Electrolimit Strain Gage, and its Application to an 84-inch Strip Mill. The Gage is Shown on the Mill Housing at A in Fig. 5

relative to it at all times. This feature has been referred to as "float."

Another application of the continuous electrolimit gage is in the classification of sheets. In this operation, the gaging is done while the material is in the strip form, the sorting of the sheets being accomplished after the strip has been cut to the required lengths on the flying shear. The time relation between the gaging unit and the sorting mechanism can be accurately controlled, thus the gaging and sorting of sheets becomes a dependable operation, and the "off gage" sheets are positively separated from the approved sheets.

Still another use of the electric gage is in the application of the strain gage for measuring the pressures exerted on rolling mills. Instruments capable of recording, as well as indicating, the loads on the mill have proved their practical value in the rolling of steel, paper, rubber, copper, and on other types of equipment, where it is desirable or necessary to know the exact pressures being exerted. In common with most mechanisms, rolling mills are designed to give maximum efficiency at a predetermined rolling pressure, and the strain gage permits reaching the efficient rolling pressure, as well as reducing the hazard of equipment failure caused by unintentional overloading. Briefly, the strain gage measures the stretch in the housing when pressure is applied, and converts this stretch of thousandths of an inch into pounds pressure. The result can be read on an indicating instrument remote from the mill.

The preceding examples of the application of modern gaging equipment emphasize the importance of proper gaging methods and indicate how correctly applied gages improve quality, facilitate production, and reduce costs —in fact, even prevent abuse of equipment.

* * *

It is said that there are some 8000 metal alloys with standardized compositions in use in the arts and industries, of which about 2200 contain nickel.

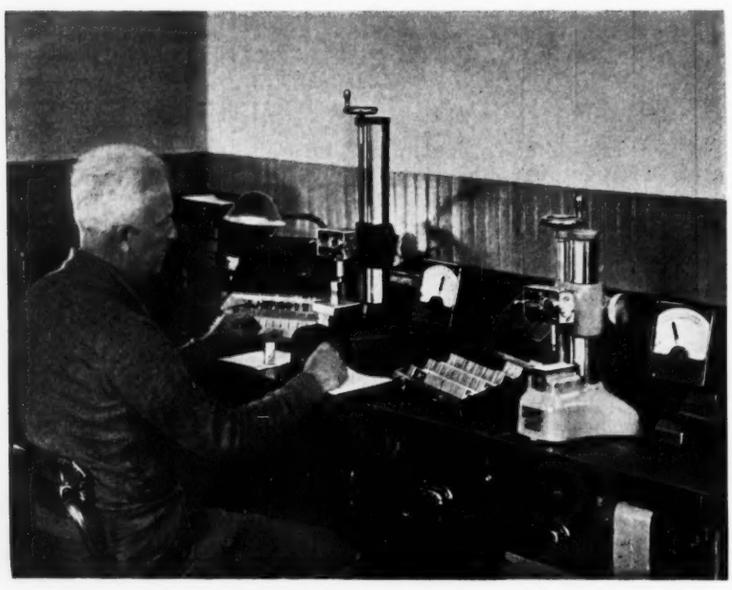
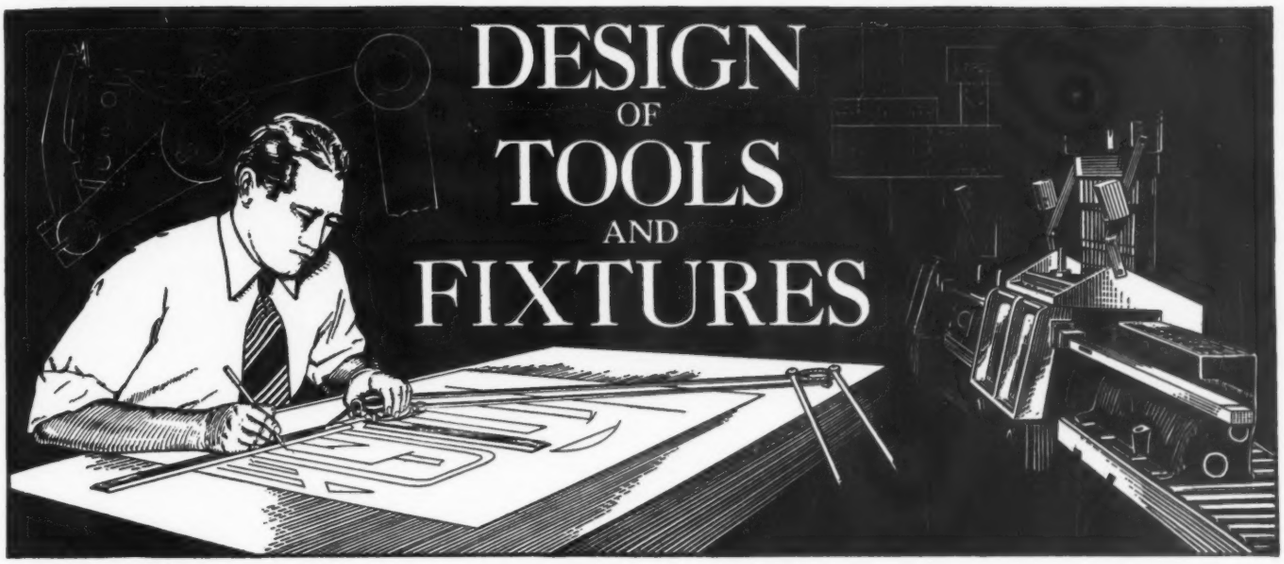


Fig. 6. Checking Hoke Precision Gage-blocks with a 10-inch Electrolimit External Comparator. Each Division of the Scale is Equivalent to Five Millionths Inch




## Elliptical Turning Attachment for Lathe

By JAMES H. RODGERS, Toronto, Ontario, Canada

The lathe attachment shown in Fig. 1 is designed for turning a large variety of elliptical shapes of various diameters and depths within the adjustment range of the device. By making slight modifications in the design of the base casting, this attachment can be adapted for use on boring mills. It can also be adapted for use on a planer for cutting elliptical grooves of various cross-sectional shapes and sizes in work of any desired length.

The base *A* of the attachment is mounted on the saddle of a lathe from which the main cross-slide has previously been removed. Integral with the rear of the base are bearings that support the mechanism that operates the cross-slide *B*. An arm, integral with and extending to the right of slide *B*, carries the bearing that supports the mechanism which operates the lateral slide *C*. The left end of this arm carries the auxiliary slide *D* which is used for setting the tool to cut to size.

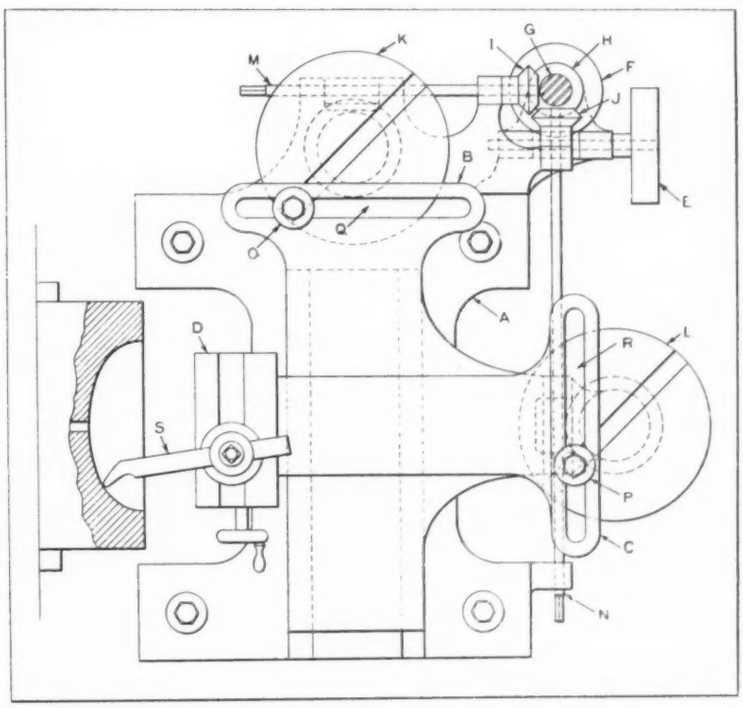



Fig. 1. Lathe Attachment Designed for Turning Elliptical and Other Shapes

The cycle of mechanical movements is as follows: The mechanism is driven by belt pulley *E*, which, through its shaft and worm, drives the worm-wheel *F* attached to the vertical shaft *G*. This vertical shaft carries a clutch and double gear *H* that can be disengaged from gears *I* and *J* when disks *K* and *L* are being set in the desired positions.

With gear *H* disengaged, the disks *K* and *L* can be independently located at any desired positions by means of a crank placed on the squared ends of shafts *M* and *N*. When the disks are in the proper starting positions, the distances the respective slides will travel are determined by the radial settings of the crank blocks *O* and *P*.

The rotary motion of blocks *O* and *P* in the slots *Q* and *R*, with these mechanisms acting in unison, imparts the required planetary motion to the cutting tool *S* for generating the predetermined elliptical shape. The illustration, although diagrammatic, shows clearly the principle involved in developing or generating elliptical contours.

Three different shapes that can be generated by different settings of the attachment are shown at *A*,

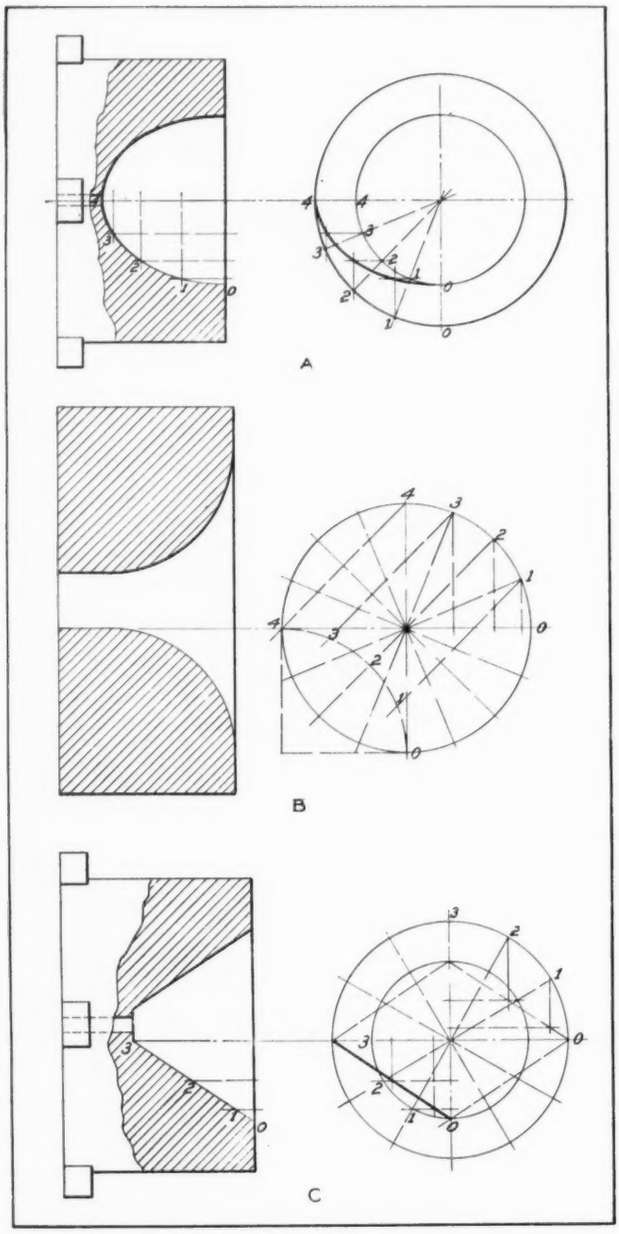



Fig. 2. Examples of Die Shapes Turned with Attachment Shown in Fig. 1

*B*, and *C*, Fig. 2. These settings are for circular, elliptical, and conical shapes, the latter varying according to the strokes of the cross and lateral slides and their starting points.

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## Notching Die with Piercing Punches that can be Placed in Operation or Left Idle

By VICTOR S. VOIGT, Tool Designer
Westinghouse Electric & Mfg. Co., Mansfield, Ohio

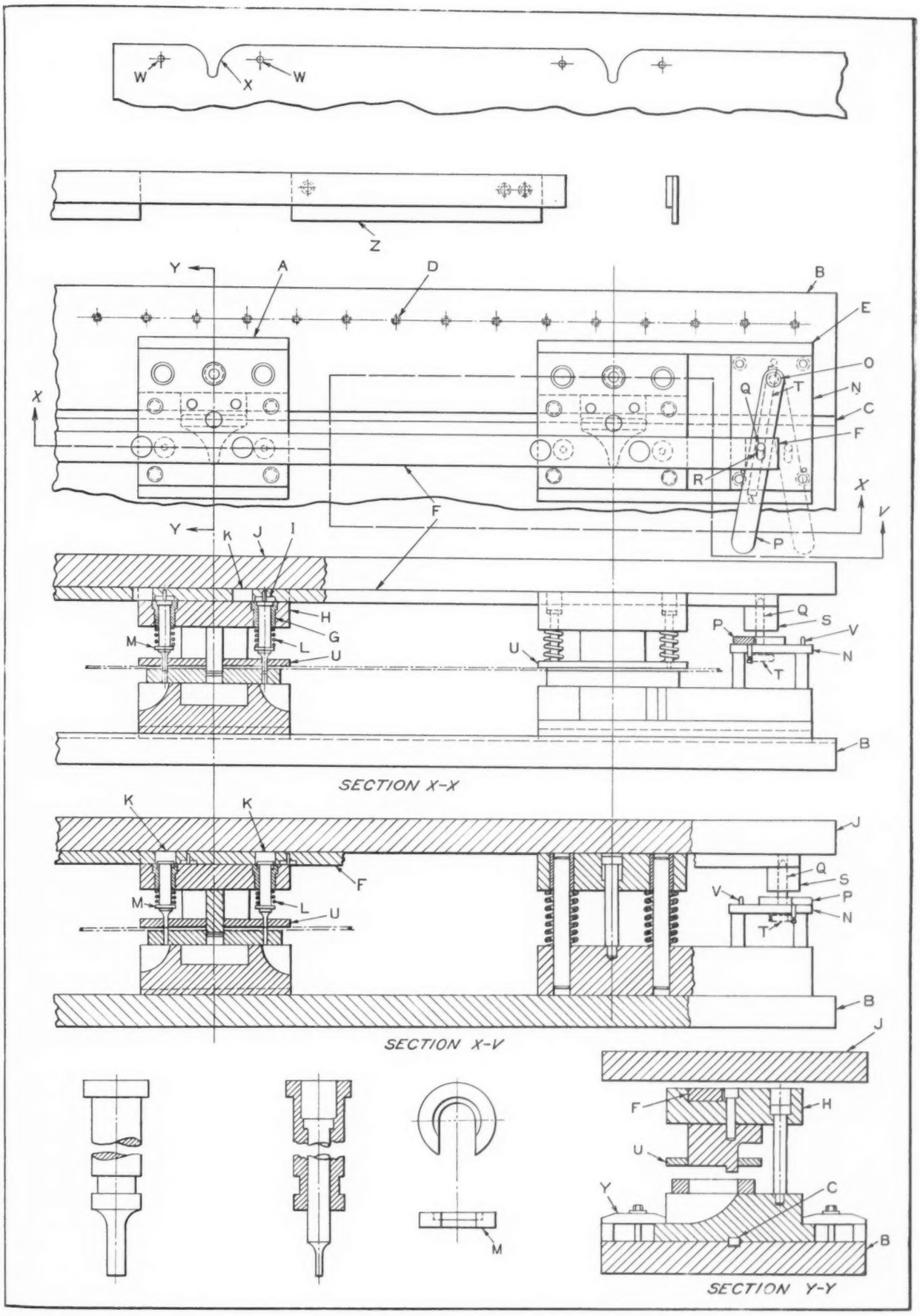
In fabricating the outer shells of refrigerator cabinets, several holes and notches, such as shown at *W* and *X* in the accompanying illustration, must be punched along the top edge of the sheets. Similar notches *X*, without the holes *W*, must also be punched along the bottom edge of the sheets. It is necessary to do this notching and piercing after blanking a large opening or hole for the door in each sheet and before the sheet is bent to form the three sides of the outer shell of the cabinet. After the door opening is blanked, the sheet must move continuously from one operation to the next until it is formed and welded to the back panel of the refrigerator.

Lack of floor space for storage between operations, danger of scratching the large finished sheets during successive stacking and unstacking, and time wasted in stacking made continuous fabrication necessary. Lack of floor space also prevented the use of one press for piercing and notching the top edge and another press for notching the bottom edge. It was also desirable to use a die that could be quickly adjusted for use in fabricating outer shells for any one of several sizes of cabinets. This necessitated having the notching and piercing units of the die adjustable to accommodate the different distances between the notches on sheets for different sized cabinets. Several types of dies were considered for this operation, but the one described in this article was finally chosen as being the most practical.

Four self-contained die units like the one shown at *A* are mounted on the die-shoe *B*. These die units can be set for different spacings by being slid along keyway *C* and held down by clamps *Y*, as shown in section view *Y–Y*, which are held by screws in tapped holes *D*. The self-contained unit *E* at the end is permanently fixed to the die-shoe. Each unit has its own guide pins, as shown in section *X–V*, around which are located heavy springs which force the punch-shoe upward when the press ram ascends. The punches are not fastened to the ram. A heavy plate *J* is clamped to the ram, and on the down stroke of the press, pushes the punch-shoes *H* and the punch-bar *F* downward.

The round piercing punches, made as shown in the two views in the lower left-hand corner of the illustration, are mounted so that they slide in hardened bushings *G*, which are pressed into punch-shoe *H*. When punch-bar *F* is in the position shown in section *X–X*, the punches bear on hardened plugs *I*, carried in the punch-bar and pierce the work sheet when the ram descends. When the punch-bar is in the position shown in section *X–V*, the punches are pushed up into the clearance holes *K* in the bar when the ram descends and, consequently, do not pierce the work sheet. As the ram is withdrawn, light springs *L*, bearing on the slotted washers *M*, force the punches down so that the punch-bar can be shifted. These springs are light enough to avoid bending the sheet material.

The punch-bar can be shifted from side to side by means of the mechanism operated by lever *P*. On the die pad of the fixed unit *E* is mounted a supporting plate *N* which carries a pivot pin *O* at the rear end. The manually operated lever *P* turns about stud *Q*, which engages a slot *R* in block *S*,




Notching and Piercing Die for Use in Fabricating the Outer Shells of Refrigerator Cabinets of Different Sizes Requiring Variations in the Spacing of Notches and Pierced Holes

attached to the punch-bar. Thus the punch-bar moves sidewise when the operator pushes the lever *P*. A toggle spring *T* holds the lever at whichever side it is placed. Motion of the bar is limited by stop-pins *V*.

In setting up the die, the movable units *A* are spaced with a gage *Z* to suit the size of cabinet shells being made, after which they are clamped in place. The operator puts the top edge of the sheet into the die under the strippers *U* and fits the door opening (not shown) over gages which are carried on the supporting bars. The punch-bar is then shifted to the position shown in section *X–X*, and the press tripped. On the downward stroke, the die pierces and notches the work, as shown at *W* and *X* in the upper view of the illustration. The operator and his helper then turn the sheet over and put the bottom edge into the die, gaging its position again from the door opening. After shifting the punch-bar *F* to the position shown in section *X–V*, the press is again tripped to notch the bottom of the sheet. The die described is being used twenty hours a day, and has been in operation for several years without giving any trouble.

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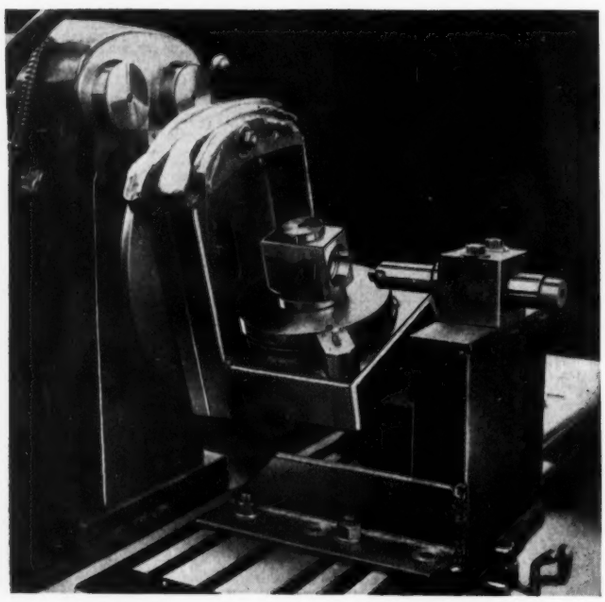
## Equipping a Milling Machine for Lathe Work

By O. S. MARSHALL, Pasadena, Calif.

When machine tools of a certain type are overburdened with work, while those of another type remain idle, the possibility of equipping the idle machines to handle some of the excess work may well be considered. In the accompanying illustration, is shown a milling machine equipped to handle a boring job in a plant where the lathes happen to be the overworked machines.



Milling Machine Equipped for Boring and Facing Operations

The special equipment required to convert the milling machine into a chucking machine consists of a tool-holder, fabricated from channel iron welded together, and an indexing fixture, mounted on the spindle of the machine. The tool-holder is machined for attaching it to the milling machine table and has a clamping block designed to hold round boring-bars.

The tool-block is split on one side and is provided with bolts for clamping the boring-bars in position. It will support drill chucks or drills held in sleeves, as well as ordinary boring and turning tools.

The indexing fixture is also of welded construction and is attached to the work-spindle by means of an ordinary faceplate. This fixture was also designed for use on lathes and shapers, and was previously described in MACHINERY.

* * *

## Machines and Their Relation to Working Hours

A booklet entitled "Machines and Working Hours" has been published by the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill. The information given is based upon statistics of the United States Census Bureau and other data collected by the Institute. One conclusion drawn from the data presented is that mechanization creates more jobs than it supersedes. Factory employment has increased 83 per cent above the 1899 level, when less machinery was used than now, while the population has increased only 72 per cent.

Although it has been possible throughout American industrial history to reduce working hours from period to period, the work week is now being reduced out of all proportion to the increased output per worker. Working hours have been reduced more since 1929 than in the thirty years preceding. Although machinery affects the manufacturing industries more than any other, employment in these industries in June this year was 5 per cent above the 1929 average. In the non-manufacturing industries, where machinery plays a less important part, employment was 3 per cent below the 1929 average.

The fallacy that shorter working hours insure more general employment is also pointed out. For example, in the construction industry, where hours are among the shortest, employment is only 55 per cent of the 1929 level, while in all other fields, the 1929 level has just about been reached.

* * *

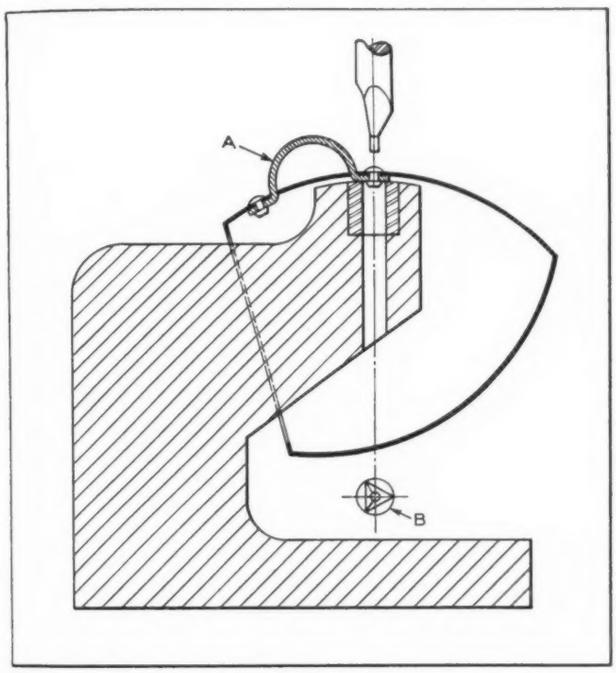
In April, 1902, this item of news appeared in the press: "Charles M. Schwab's motor speed record from New York to Philadelphia has been eclipsed by F. F. Georges, who, with three companions, made the trip in four hours and eight minutes."

# Ideas for the Shop and Drafting-Room

**Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work**

## Punch and Die for Removing Rivets

Occasionally, automobile lamp shells and similar products require reprocessing, due to imperfect plating or other defects. In such cases, it is necessary to remove all assembled parts. The removal of riveted brackets, such as shown at *A* in the accompanying illustration, presented a problem. At first, it was the practice to drill out the rivets to permit disassembling the parts. This method, however, was slow and unsatisfactory and led to the construction of the horn type die shown in the illustration.




Die for Removing Rivets from Assembled Parts

The lamp shell is placed over the horn of the die, locating the rivet head in the hardened bushing. The piercing punch is slightly smaller in diameter than the body of the rivet, and the tapered section between the piercing end and the body of the punch is filed or machined to a triangular shape, as shown in the end view at *B*.

The operation consists simply of piercing through the rivet head and pushing the rivet body through the assembled parts. The pierced rivet head remains on the punch. Continued piercing causes the rivet heads to accumulate on the punch and they are forced upward and over the triangular shaped portion until they split and fall off. The lamp shell requires no stripper, as the piercing punch is smaller than the hole left by the removed rivet. This method can, of course, be applied to many similar jobs.

Detroit, Mich. JOHN J. MCHENRY

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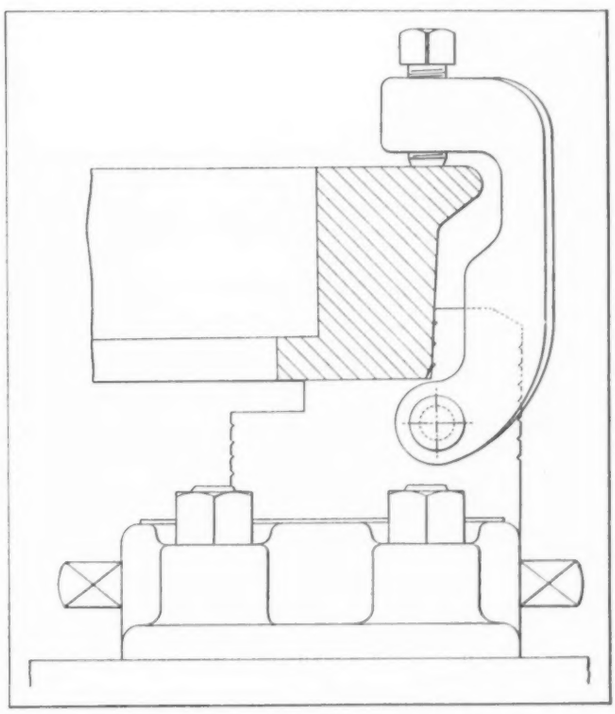
## Clamp Attached to Chuck Jaw Provides Added Security

Chuck jaws cannot be expected to hold all kinds of work securely. For example, a railway tire that is gripped on the tapered section, as shown in the accompanying illustration, requires additional clamping means to insure holding the work securely under a heavy cut. This additional holding power is provided by the "swing away" type of clamp shown. The clamp is pivoted in the chuck jaw by a removable pin.

Some boring mill chucks have clamps similar to the one shown, which are tightened down on the work by means of tapered cotters or wedges. The wedges are simply tapped lightly to give the necessary clamping pressure.

Bath, England FRED HORNER



Clamp Attached to Chuck Jaw for Added Security in Holding Tapered Work

# Questions and Answers

**A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries**

C. A. D.—Some time ago we shipped a machine to a customer. There was no indication on the contract whether the sale was "cash" or "terms." Recently when we demanded payment, the purchaser stated that he intended to pay for the machine in installments, as he had done on other machinery he had purchased from us in the past. What is the law on this subject? If we agree to accept installment payments, and the purchaser fails to make these payments in accordance with the agreement, can we immediately take possession of the machine?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

The law implies that a person who purchases anything will pay cash, although neither party mentions whether the account shall be paid on a cash or a credit basis. (185 F. 373) Also, where the customer refuses to make cash payment, the seller is legally entitled to file suit and collect in full. Moreover, where the purchaser agrees to pay a certain amount down and the balance at specified periods, the total amount of the account falls due immediately if the purchaser fails to make any payment in accordance with the terms of the original agreement.

For example, in a recent case (168 Ill. App. 64), it was disclosed that two persons entered into an agreement whereby the debtor agreed to pay stipulated amounts monthly until the full account was paid. The Court held that since the purchaser failed to fulfill the agreement, the entire amount automatically came due immediately. Also, the seller can repossess the machine, if he wishes, should the purchaser fail to pay according to the contract.

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## Alloy Cast Irons

M. M.—I understand that great progress has been made in developing alloy cast irons during recent years, but when I heard someone talking about cast iron with 80,000 pounds per square inch tensile strength, some days ago, I wondered if this was an exaggeration. Would you kindly give me a few facts about the new cast irons?

Answered by V. A. Crosby
Climax Molybdenum Co., New York City

The metallurgical knowledge of producing cast iron with tensile strengths as high as those mentioned by your correspondent without sacrificing other desirable qualities must be considered one of the most outstanding developments of recent years. Tensile strengths in alloy cast irons as high as 85,000 pounds per square inch are now regularly obtained. More than ever before, it is being demonstrated that cast iron is industry's most versatile material. Recent discoveries have opened up new fields of application for this material.

Concurrently with the development of improved tensile properties, metallurgists have given us compositions with greatly improved impact or toughness properties. The high-strength cast irons have high fatigue resistance, good casting characteristics, and excellent wear resistance. This is evidenced by the fact that they are now being regularly used for automobile crankshafts and camshafts and for other machine parts requiring both high strength and outstanding fatigue resistance.

The process of melting and refining to obtain these outstanding characteristics generally makes use of an electric furnace. A high percentage of steel is used in the mix. Late graphitization is effected by adding two-thirds of the silicon only three to five minutes before pouring. The highest temperature should not exceed 2750 degrees F., and the pouring temperature should be about 2650 degrees F.

The chemical composition of such cast iron would be about as follows: Carbon, 2.5 per cent; silicon, 2.75 per cent; manganese, 1 per cent; molybdenum, 1 per cent; nickel, 1 per cent.

Cast iron of this composition has shown a tensile strength of 85,800 pounds per square inch with the American Society for Testing Materials' standard test pieces. The tensile strength in the center of a 2-inch section was 76,550 pounds per square inch.

* * *

## German Investigations of Surface Qualities and Finishes

Recently a book has been published in German entitled "Technische Oberflächenkunde," by Dr. Gustav Schmaltz, owner of the Schmaltz Bros. Machine Works, Offenbach on the Main. This book contains the first comprehensive review of what has been done in the investigation of surface finishes, and contains a great deal of interest to engineers who have given this subject special attention. The book is published by the firm of Julius Springer, Berlin, Germany, and contains 286 pages, with 396 illustrations.

# Stainless Steel Finds an Ever Broadening Field of Application

THE remarkable increase in the production and use of stainless steel from year to year, even during the most severe depression period, is a definite indication of the firmly established place of this new material in the industrial field. Tonnages of ordinary steel production declined sharply from 1929 to 1933; during the same period, the production of stainless steel continuously increased. Furthermore, since 1933 the recovery in ordinary steel products has been gradual, while in stainless steel the increase has shown a constantly accelerated pace. In 1929, the tonnage of stainless steel produced was 40,000. In 1936, 102,500 tons of stainless steel ingots were poured, representing a 52 per cent increase over 1935, and more than two and one-half times the output in 1929. At the same time, stainless steel castings were produced in 1936 to the extent of 6500 tons, an increase of 20 per cent over 1929.

The well-known 18-8 stainless steels continue to account for the bulk of the production, or 53 per cent of the total tonnage. About 21 per cent is accounted for by the straight 16 to 18 per cent chromium steels, and about 12 per cent by 12 to 14 per cent chromium steels. The balance of 14 per cent represents several varieties of heat-resistant and corrosion-resistant alloys, including the 16 per cent chromium and 1 to 2 per cent nickel steel largely used in the construction of aircraft.

The remarkably rapid increase in the production of stainless steel is due mainly to its ever widening fields of application. At first, stainless steel was used almost entirely for making rustproof cutlery and other tableware; today, its applications have expanded until this new material has become a most important factor in many industries, especially those concerned with oil, textiles, chemicals, motor cars, paper, tubes, aeronautics, building, and house furnishing.

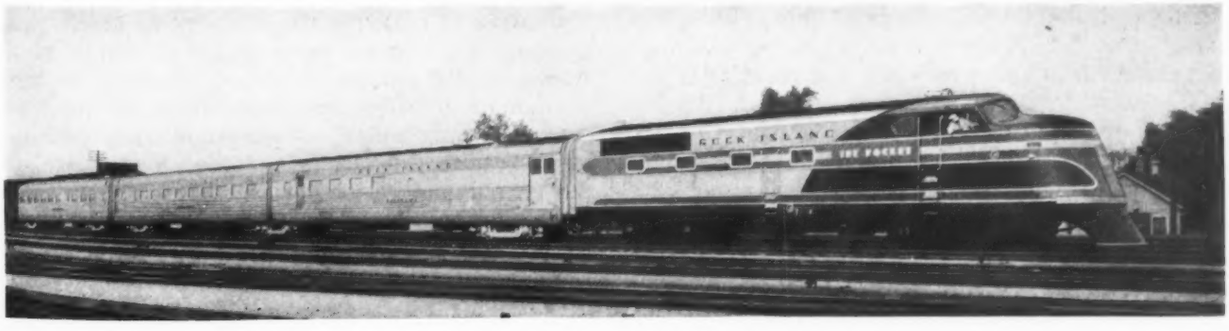
The *Electromet Review* mentions that, in 1936, streamline trains alone consumed as much stainless steel as was produced in the United States in 1926, and that the consumption in the textile industry grew from a total of less than 20 tons in 1930 to nearly 1000 tons in 1936. Furthermore, one concern that manufactured 1500 stainless steel cooking utensils in six months in 1932, now makes this number every day in the year.

Another indication of the growth of the use of alloy steel in general, including stainless steel, is found in the production figures of one well-known steel company. Two-thirds of the production of this company now consists of alloy steels that were either totally unknown to the metallurgical world, or, at best, were laboratory products, prior to 1919.

Apart from its corrosion-resisting qualities, stainless steel has found new applications because the metal has exceptional physical properties, both at very low and at very high temperatures, as well as at ordinary room temperature. A comparatively few years ago, only a few mills produced this type of steel, but today, it has become a standard product of a great many steel companies.

* * *

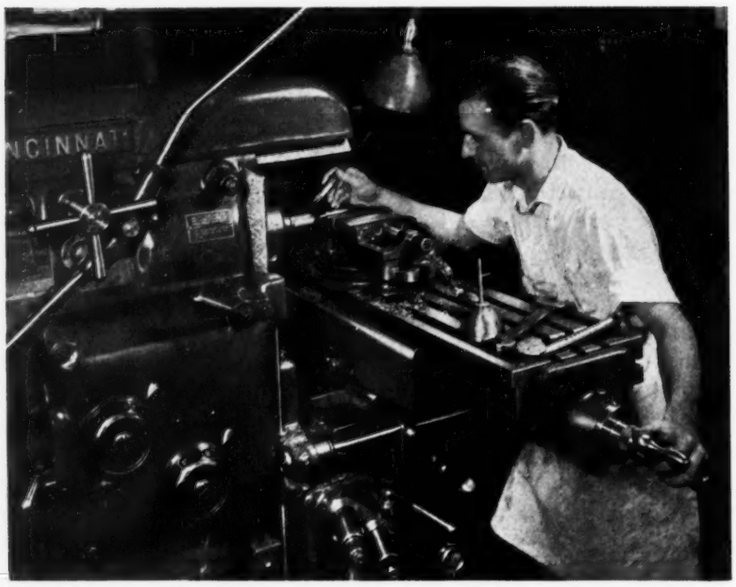
Not long ago an employer and one of his men fell into conversation about matters that were perplexing both, and the employer asked, "Just what is it you want?" "We want industrial freedom," said the man. "That sounds good to me," said the employer, "I would like some of it myself. How do you get it?"—From an address by *W. J. Cameron*, on the Ford Sunday Evening Hour



First of a Fleet of Six New Stainless Steel Streamline Trains being Built by Edward G. Budd Mfg. Co. for the Rock Island Lines. These Trains Have 1200-H.P. Diesel Locomotives Built by the Electro-Motive Corporation

# Training Learners for Production Operations

By WARNER SEELY, Secretary
The Warner & Swasey Co., Cleveland, Ohio



A Young Man Becoming Proficient in Operating a Milling Machine

WHILE the country at large is talking about —but completing slowly—the taking of a federal census of unemployment, there are industries in which the problem of idle men does not now exist, and has not existed for months. Recent surveys made by the National Industrial Conference Board, technical and trade journals, and manufacturers themselves all point to the same general conclusion—that the shortage of skilled men in industry which began almost with the up turn of industrial activity in 1933 has become widespread.

In the machine tool industry, employment has advanced steadily since October, 1934, with the exception of a single month, May, 1935. The current level of employment in that industry exceeds that of any month since June, 1930, and is more than three times as high as the low point of April, 1933.

If this shortage of skilled workers was confined to the machine tool industry, it would be serious enough. That it has become the common experience of companies in many other industries where metal-working activities are a part of the manufacturing processes is attested by the replies of 229 concerns, employing nearly 800,000 workers, to a questionnaire sent out by the Warner & Swasey Co. Not less than 192 companies reported a definite shortage of skilled men. Moreover, from the comments volunteered, it was evident that the shortage is of such a character that it can only be relieved as *new* men are found and trained to replace those who, through death or old age, through transfer to other occupations from which they are unwilling to return, or through irremediable loss of skill, are no longer available.

It is doubtful if the shortage of trained men has been more keenly felt at any time in the country's history than at present. Not even during the World War—if published figures are to be believed—was there a much greater demand for skilled workers than today. Furthermore, according to recent estimates of the National Industrial Conference Board and others, if the current volume of production and trade, and output per man-hour, continues to increase at the same rate as during the last four years, and prevailing hours are maintained, *all* the existing employable labor surplus, both skilled and unskilled, will have been absorbed before 1940. Thus it would appear that industry faces a general and serious labor shortage. If, as appears entirely probable at this time, working hours in many industries are further reduced, that general labor shortage will materialize even sooner.

### *What is Being Done to Train Men for Industry's Needs?*

Many manufacturing concerns, it was indicated in the answers to the questionnaire, are establishing or re-establishing apprentice training programs in an effort to meet the situation. How quickly men can be trained to the point where they can safely be trusted with full-fledged production assignments on high-priced machine tools remains a question of real concern, and one to which, at the moment, no two answers would probably be the same. It is a matter of record, however, that new equipment is being purchased in some volume to meet not only enlarged manufacturing schedules by increasing the productivity of men already on the payroll, but also to speed the employment on production work of new men as yet relatively untrained.

A really efficient man, as is generally recognized, must have had not only a thorough training, but also a considerable amount of practical experience. Where an industry has, however, sustained the permanent loss of a considerable number of skilled workers—variously estimated at as high as 5 per

cent a year during the depression years—and until very recently has done little toward the re-establishment of the suspended training programs, anything which has been, or can be, done to bridge more speedily the gap in the supply and demand for trained men should be of considerable interest.

### *Can Men after a Few Weeks of Special Training be Trusted with Modern Machines?*

How, the question is asked, can new machines be entrusted to men who not only have not had thorough training, but who also lack any background of practical experience? The answer to this question cannot, of course, be the same in every case in which learners are actually being introduced into full-fledged production. However, the Warner & Swasey Co. has personal knowledge, through its follow-up of purchases of its turret lathes by other concerns, that a gratifying degree of success is attending the efforts of these manufacturers to put new, rather than more skilled men, at work on this kind of equipment.

Moreover, the Warner & Swasey Co. has set about in its own shops to determine how quickly sufficient training can be given the beginner to permit him to do certain jobs within acceptable standards of precision and versatility. The evidence obtained from its own experience with groups of learners after as brief preliminary training periods as six weeks has shown that many were quite capable of handling the latest types of mechanical equipment with sufficient proficiency to be placed in a regular production department.

There are several factors that would appear to make feasible the program of putting new men on new machines. In the first place, modern equipment has built into it a great deal of "information" which heretofore was available only to the most skilled operators, and to them as a matter of acquired knowledge from long years of actual operating experience. Reference need only be made, for example, to the elaborate charts of speed and feed combinations available on today's machine tools that tell even the most inexperienced worker at a glance the combinations and capacities available in the unit.

In the second place, modern equipment carries a multiplicity of interlocking controls, which render it practically impossible for even a novice to accidentally combine operations that would conflict with each other. Interlocks cover the operations of screw-cutting engagements, for example. Interlocks on the turret lathe apron automatically stop or trip out the threading movement if, for any reason, an inexperienced operator tries simultaneously to introduce a cross-feed.

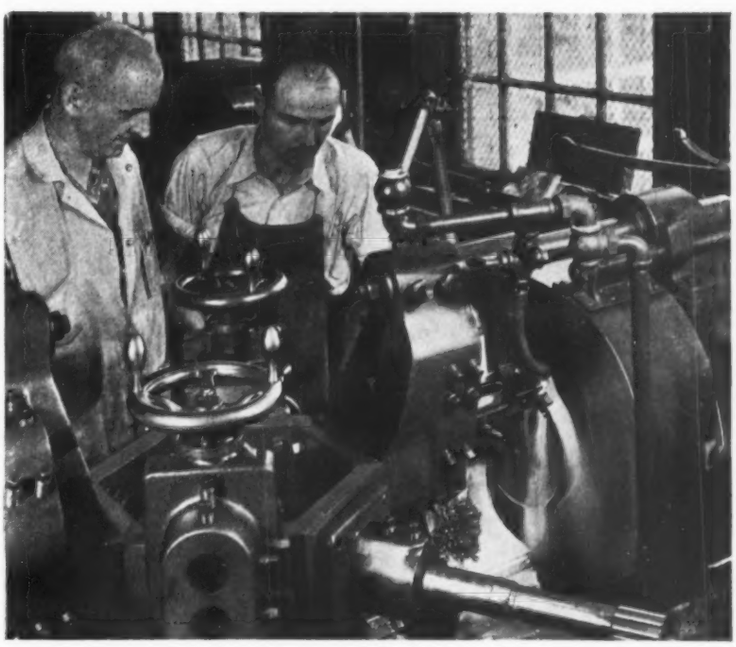
The greater capacity of the modern machine to meet overload problems is another factor of importance. Micrometer dials further minimize the errors that the inexperienced operator could introduce into his work if he were allowed to depend on his own sense of accuracy and "feel." Air chucks and electric chucks facilitate the handling and setting up of the work itself. Many additional features are built into the modern machine that definitely help the new man.

The large number of operations that can be set up at a time is another factor of prime importance in today's machine tools. An experienced set-up man, for example, can establish a whole sequence of operations on a modern turret lathe, and the machine can then be turned over to a relatively inexperienced man to run on a production basis.

### *The Experience of the Warner & Swasey Co. in Training Operators*

Has Warner & Swasey's experience been uniformly satisfactory in taking beginners and, after a few weeks of general instruction, putting them on work which on older types of equipment could only be safely entrusted to more skilled workers? The most conclusive answer to that question would appear to be provided by an examination of actual figures recording the results obtained with new men in the company's learner course.

From May, 1935, to August, 1937, the Warner & Swasey Co. hired, in all, 357 men for its learner's course. Of these, 154 have become operators skilled in performing operations on one or more machine tools; 57 have progressed so that they have had one raise in pay, while 67 have had no raise; 73 of those originally hired are no longer with the company. Of these, 6 were laid off because suitable work was no longer available, 40 quit of their own volition, and 27 were discharged. Six men have



Foreman Instructing a Learner in the Operation of Turret Lathes

been transferred to other work within the company.

Expressed in percentages, approximately 43 per cent have become skilled operators, 16 per cent have received one raise in pay, while 19 per cent have received no raise. Twenty per cent have left the company's employ, while 2 per cent have been transferred to other work. Of those that are no longer with the company, 11 per cent left voluntarily, 7.5 per cent were discharged, and less than 2 per cent laid off because of lack of the particular work for which they were suited.

* * *

## Machine Tools and the Standard of Living

The National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland, Ohio, has published a booklet entitled "Life, Liberty, and the Pursuit of Happiness," in which is shown by contrasts, through illustrations and descriptive text, what has been accomplished during recent years, by improved manufacturing facilities, in providing the conveniences and comforts of everyday life. The booklet compares mechanical aids used in the home a few years ago and today, and indicates the improvements that have been made in washing machines, radios, automobiles, office equipment, etc., in a comparatively small number of years. It emphasizes how all this progress has been made possible by improved machinery for manufacturing the improved devices in daily use.

* * *

The October factory sales of motor vehicles are estimated at about 341,000 cars and trucks, an increase of 94 per cent over September this year, and 48 per cent over October last year. The total for the first ten months of the year was 4,296,000.

## September Machinery Exports Show Continued Increase

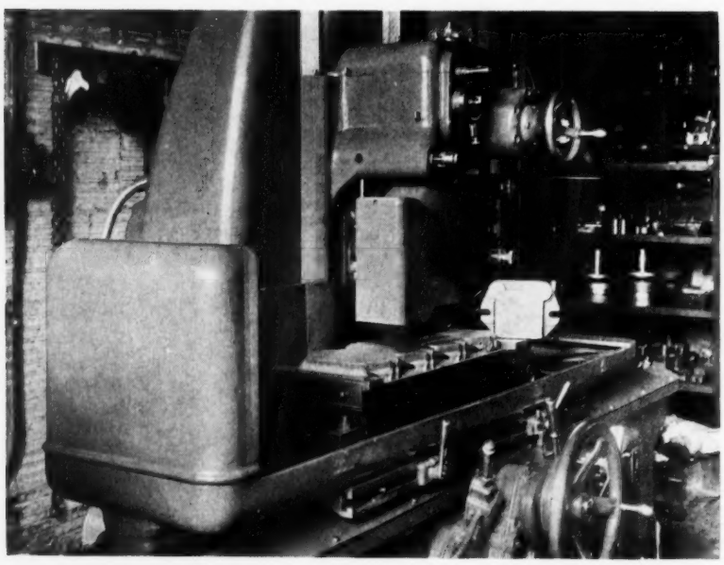
According to statistics compiled by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., the exports of machinery from the United States in September totaled $19,724,000, representing a gain of 50 per cent over the corresponding month last year. The exports for the first nine months of the year aggregate over $182,000,000, which is about $13,000,000 more than the shipments for the entire year of 1936.

The exports of power-driven metal-working machinery increased nearly 20 per cent in September, compared with the same month last year. The total exports in this group amounted to $3,902,000. Marked gains are noted in the sales of engine lathes, thread-cutting and automatic screw machines, milling machines, radial drilling machines, surface grinding machines, cylindrical grinding machines, planers, and shapers.

* * *

## A New Metallurgical Research Laboratory

The American Rolling Mill Co., Middletown, Ohio, has just completed a new research laboratory that stands out as one of the most modern in the industrial field. The building has a length of 255 feet and a depth of 175 feet, with a total floor space of 43,500 square feet. The entire building is of welded-steel construction, not a single rivet having been driven in the structure. Even the ventilation and air-conditioning are of the most modern type, being controlled by two air-conditioning systems, one for the research staff offices, and one for the testing shops. A group of well-known scientists attended the recent opening of the laboratory.



Grinding Cast-iron Die-shoes on a Mattison Surface Grinder, Removing 0.020 Inch of Metal from Both Sides of Four Castings in Twenty-four Minutes. Previous to Adopting this Method, this Work Required Thirty Minutes per Piece, or Two Hours for Four Pieces

# Progress in Oxy-Acetylene Welding and Cutting

THE oxy-acetylene flame has become more important during the past year than ever before. It is now a necessity in practically all industries. The latest revisions in the Boiler Repair Rules issued in 1936 by the National Board of Boiler and Pressure Vessel Inspectors defined the extent to which fusion welding can be used in the repair of steam boilers. These rules definitely establish the recognition of fusion welding for this type of repair. Tests recently completed have also opened the way toward the much wider use of bronze-welding by gas and water companies.

The suitability of welding and cutting as tools in the construction and repair of bridges has been acknowledged through the publication of a booklet by the American Welding Society entitled "Specifications for the Design, Construction, Alteration, and Repair of Highway and Railway Bridges by Fusion Welding."

Decided progress has been made in the past year in the welding of alloy materials. Reliable information on the welding of practically the entire range of commercial metals is available today. Methods are specified and the materials and apparatus for satisfactory work can be obtained. The bronze-facing of Monel metal is an application that has proved extremely useful in several instances.

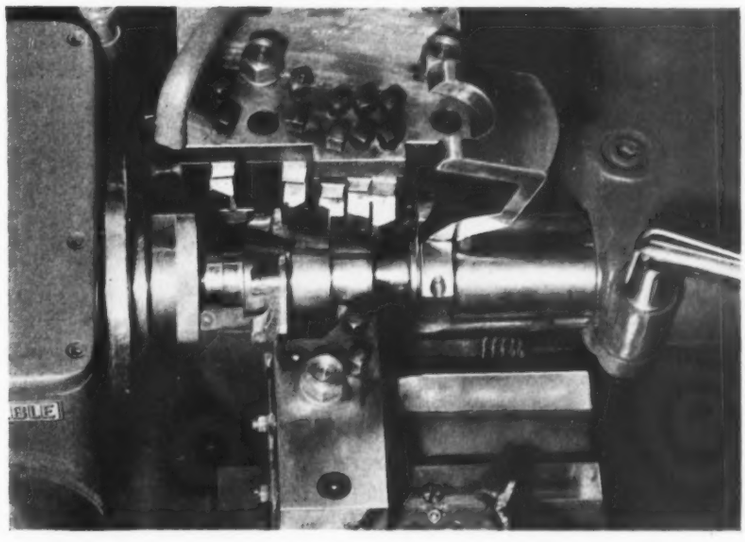
Pipe welding has found ever increasing applications. The oxy-acetylene welding of industrial piping has resulted in greater speed and economy in this type of work. There has also been great activity in overland welded pipe-line construction. In one instance, the frame of a building approximately 20 by 50 feet and 20 feet high was constructed entirely from welded pipe.

The use of welding in heavy construction is more marked than ever. A great many applications of welding and cutting were utilized on the Grand Coulee Project, the Bonneville Dam, the Fort Peck Dam, and similar projects. Among the applications in these projects may be mentioned the welding of pipe lines for various types of service, flame cutting of steel shapes, hard-facing of construction equipment, and the repair of damaged machinery.

Progress in the oxy-acetylene industry has been particularly marked by the development of new apparatus for performing welding and cutting operations. Among the most outstanding advances have been those in the field of machine cutting. With the introduction of this new equipment, flame cutting has been correspondingly advanced as a process. New oxygen and acetylene regulators have also aided in advancing the successful application of the flame cutting and welding process.

In the machine shop field, there has been a marked increase in the applications of fusion welding. A widespread advance has been made in the use of oxy-acetylene welding in automobile and parts manufacturing, more especially in body building. With the continued development of new welding machines to meet specific operation requirements, the advance in both automatic and semi-automatic operations has been noteworthy. The modern automobile, to a large extent, is a product of welding by several processes.

In the manufacture of machinery, there has been a tremendous advance in the use of rolled steel, cut to shape and welded. Such welding is especially to be noted in machine bases and frames of all types. During the past year there has been a very rapid adoption of this method in the machine-building industries. There has also been a decided trend toward the use of a combination of shape-cut rolled materials and cast parts, in order to obtain the greatest possible efficiency and flexibility, both in design and in production methods.



Finish-turning Eight Surfaces Simultaneously from the Rough on the Porter-Cable Machine Co.'s Carbo-Lathe, by the Use of Stellite Tools. Production, 42 Pieces an Hour. The Material Cut is a Steel Forging. The Work is Mounted on a Splined Arbor, Held Stationary in the Spindle; it is Forced on and off the Arbor by the Air-operated Tailstock

# Westinghouse Provides New Motor Manufacturing Facilities

Fig. 1. General View of the Shaft-machining Department, Showing Arrangement of Machines and Conveyors

TO meet the steadily increasing demand for industrial motors and to provide adequate means for economical manufacture, the Westinghouse Electric & Mfg. Co., at its East Pittsburgh, Pa., plant, has just provided new manufacturing facilities for the manufacture of motors from 1 to 50 horsepower, weighing from 50 to 1500 pounds each. A building 1450 feet long has been completely arranged as a motor manufacturing "aisle," the entire installation covering a floor space of 270,000 square feet. This building is used exclusively for motor manufacture, and provides an unusually comfortable, well lighted and well heated shop, conforming with the idea that good quality work comes from good working conditions.

In the newly equipped plant are installed approximately two miles of conveyors of various types, including gravity roll, belt, chain, slat, and live-roll conveyors. Crane facilities ranging from simple chain hoists to a 10-ton overhead crane are provided. Adequate railroad spurs provide means for receiving approximately 700,000 pounds of sheet steel, 150,000 pounds of bar steel, and 1,000,000 pounds of castings every month.

In equipping the shop, $220,000 worth of new machine tools were purchased and added to the manufacturing equipment already available. This equipment is so arranged that the manufacturing proceeds in a practically continuous straight line, the finished motors being shipped at the end of the building opposite that where the raw materials enter.

In planning the materials-handling system of the plant, the principle was kept in mind that the best method of handling any product is generally conceded to be that which handles it the least; hence liberal use has been made of conveyors, chutes, etc.

One of the most interesting things about this motor manufacturing plant is the fact that such a large variety of motors—actually running into thousands of sizes and types, considering horsepower, types of winding, frames, etc.—are produced in the same manufacturing aisle simultaneously. The plant is not a mass manufacturing plant in the sense that one day only one type of motor passes through the aisle, while the next day the aisle may be changed over

Fig. 2. High-frequency Testing of Motor Stators. Illustration Indicates Large Variety of Sizes and Types of Motors

for the manufacture of another type. On the contrary, motors of all sizes and descriptions pass through continuously, in conformity with orders to be filled. This is, perhaps, most clearly in evidence in Fig. 2, where motors of various sizes and types may be seen passing a testing station. Still the benefits of quantity production are definitely obtained, since all these motors are of a standard type, the parts for which can be manufactured in quantity for assembly as required. A separate manufacturing line is provided for special or custom-built motors.

In laying out the plant, the cooperation of all minds concerned with the final success of the project was enlisted. For example, in the design and location of each machine tool and conveyor, the lay-out engineer, the tool supervisor, the time-study men, the production scheduling department, the foreman of the department, and the general foreman were all consulted. In many instances, the design engineers suggested changes in the design of the product that greatly influenced the lay-out. Each operation was analyzed in detail with a view to keeping the machinery and men steadily employed.

The result has been the development of up-to-date manufacturing methods and processes that will insure the production of a great many types and varieties of industrial motors economically, and that will provide for expansion to meet future demands, as well as flexibility for the introduction of new methods and processes. The production system, as mentioned, is unique in that it permits so great a variety of sizes and types of motors to flow through the production aisle in a constant stream without congestion or confusion—a most remarkable achievement.

Fig. 3. Conveyor Lines Used for Passing Rotors and Stators to the Assembly Department

## Don'ts for Using Diamond Wheels in Grinding Carbide Tools

The following "Don'ts" are suggested for the guidance of the operator in using diamond wheels for grinding cemented-carbide tools:

1. Don't grind with wheel that does not run true.
2. Don't grind dry if it can be avoided.
3. Don't grind steel.
4. Don't resort to excessive in-feeds (not over 0.0015 inch per pass, and not more than 0.0005 inch on form grinding).
5. Don't run wheels under 5000 surface feet per minute for maximum efficiency. High speeds result in greater speed of cut, longer life, and better finish, except in dry grinding, where slower speeds may prove more efficient.
6. Don't use set-ups where offhand grinding will do the job just as well, since set-ups consume time and offhand grinding saves time.
7. Don't rough-grind "mixed" metals, as steel wastes the diamond wheel, and can be ground more economically with an aluminum-oxide vitrified wheel.
8. Don't divide price of wheel by number of tools ground, as this does not give a true grinding cost.
9. Don't disregard saving in time in computing grinding cost, as this is one of the most important factors that justify the use of the diamond wheel.
10. Don't expect maximum efficiency in terms of wheel life from the first diamond wheel installed. Tools will be in better condition after conditioning on the diamond wheel than they were when first presented to the diamond wheel. Some very bad tools will be ground on the first diamond wheel, and it will be necessary to remove excessive amounts of stock.
11. Don't let tools run until they are burned up, but recondition them periodically while they are still in good condition. This is economical in terms of tool life, as well as in diamond wheel life.

* * *

## Visits to Industrial Plants Useful to Vocational Students

In an address made before a group of vocational teachers, W. D. Keefe, sales manager of refrigeration division of Fedders Mfg. Co., Buffalo, N. Y., emphasized a fact often overlooked—the importance of taking the students on visits to industrial plants. Most industrial plants would be glad to permit a class of vocational students to visit the various departments and to obtain, through an experienced guide, adequate information about the different operations. The students would be greatly benefited by such visits, where they would have an opportunity to see the latest production machines and methods, and to get an idea of manufacturing routine, as well as a conception of the speed and accuracy required in engineering production.

## Welded Construction Reduces Camshaft Costs

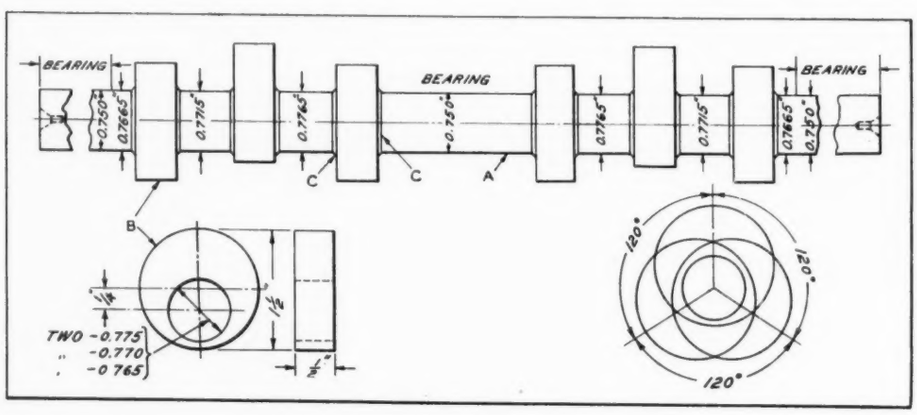
By LIONEL BOUDREAU

A small manufacturing plant reduced the cost of camshafts like the one shown in the accompanying illustration by employing welded construction. Each camshaft serves as a part of a filling machine on which it operates spring-actuated plungers. The shaft *A* has two sets of three cams *B*, with the throws indexed 120 degrees apart, as shown in the view in the lower right-hand corner of the illustration.

At first the camshafts were turned from bar stock with the aid of offset blocks. This method proved very costly, as 14 1/2 pounds of a certain alloy steel was required to make each piece. The scrap or waste material was excessive, and the turning operation took eight hours. The small number of camshafts required did not warrant the use of forgings.

As seen in the illustration, the camshaft is made in seven parts consisting of the shaft *A* and six identical cams *B*, welded as indicated at *C*. The shaft is 12 inches long and is finished to a diameter of 0.750 inch on the bearings. The rough stock is 7/8 inch, turned to 0.800 inch and rough-ground straight to 0.780 inch. The cams are made from 1 9/16-inch stock. After being cut off, the cams are surface-ground to a thickness of 1/2 inch, plus or minus 0.005 inch. Both ends of the shaft are ground to three different diameters for convenience in giving the cams a drive fit allowance of 0.0015 inch. Thus each set of cams is bored 0.775, 0.770, and 0.765 inch in diameter.

It is necessary that the six throws or cams be accurately spaced 120 degrees apart. These requirements were met as follows: The shaft was mounted between centers in a milling machine, and a pointed tool held in the arbor was used to scribe accurately spaced lines for positioning the cams. Radial lines passing through the maximum throw position were scribed on the cams, so that they are easily located and driven into place. The welding operation then follows, and the shaft is made ready to be finish-ground, 0.015 inch of stock being removed from the end bearings and 0.030 inch from the center bearing. The welding procedure had no effect on the grinding cost. Only 4 1/2 pounds of metal is now required for each shaft, and the average time for machining and assembling is 4 1/2 hours.




Camshaft of Welded Construction

* * *

## The Real Labor Problem

In one of his addresses on the Ford Sunday Evening Hour, W. J. Cameron asked: "What is our real social problem? Where does the economic shoe pinch?" He pointed out that the main difficulty of most people is in getting the things they need and want, to live as they feel they ought to live. Briefly, this is all there is to the so-called social problem—or perhaps better, labor problem. If more things were available and easily accessible, the problem would largely vanish.

What makes it hard for people to get the things they need? They are too costly. And what makes them costly? They are too scarce, And why are they scarce? Not enough of them are produced. And why are not enough of them produced? Now that is *the* question. On this question many bright minds have speculated.

It is obvious that we have more production facilities than ever before, and we have men capable and willing to produce. Fortunately for this nation, we have thousands of production men who believe in production. "If you think *that* belief is unimportant," says Mr. Cameron, "just identify in your minds the forces that do not believe in production —that are retarding production.

"Production engineers know where the economic shoe pinches—the country is under-supplied; and by insisting that our first job is to supply it, they are doing more than all the theorists to solve the social problem—yet they seldom use the term.

"Unity of social feeling and vigor of constructive effort among our people have been vastly harmed by the false propaganda that ours is a rich country. In resources, yes. Measured by other countries, yes. Measured by the American ideal—not yet. Measured by our possibilities—no. But this can be a land of plenty; it is more a land of plenty than it used to be; it must become much more so. Industrial producers have grasped the truth—'There is not enough yet, but we are on the way to making enough'— and that is the clearest practical light on 'the social problem' we have ever had. With commodities of life plentiful and easily obtained, there will not be much left of the problem."

# Replacing Worn Casting with Electrically Welded Part

THE casting shown at *B* and *C* in Fig. 1 was used as a frame around which a chain drive rotated to convey strips of wood to a shear, as shown in Fig. 2. The shear is employed in the plant of the William E. Asplin Basket Co., Cleveland, Ohio, for cutting the wood to the proper sizes for use in the manufacture of baskets. The casting became worn by rubbing against a lug on the chain as it passed along its edge. When the part became unsuitable for further use, the estimated cost of replacement of the casting was $65.

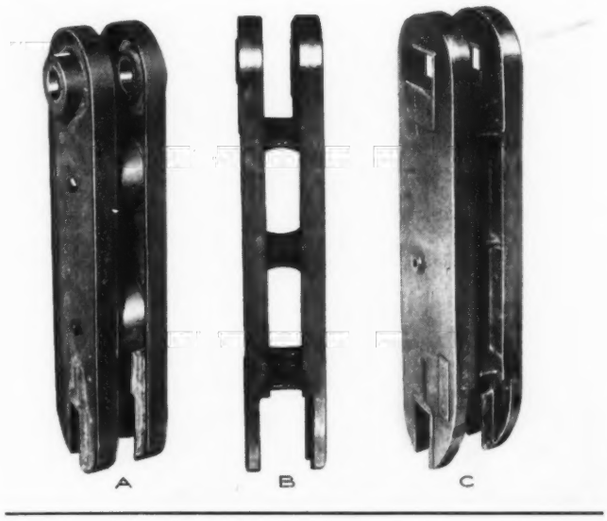



Fig. 1. (A) Arc-welded Steel Part that Replaced Worn Casting; (B) and (C) Worn Casting Replaced by Welded Steel Part Shown at A

By electrically welding mild steel shapes and plate material, the service department of the company, which for years had applied electric welding to the construction, as well as to the maintenance, of machinery, fabricated the part as shown at *A*, Fig. 1, at a total cost of not more than $10 for material and labor. The parts welded together to complete the unit weighed 58 pounds. Shielded-arc welding equipment, made by the Lincoln Electric Co., was used for the welding operations.

The part is approximately 30 1/2 inches long by 7 inches wide. It is fabricated of 1/4-inch plate, 4 1/2-inch diameter pipe spacers, 3/4-inch pipe, 5-inch cold-rolled round steel stock, 4-inch cold-rolled round stock, and a bronze bushing having an outside diameter of 2 1/2 inches. The complete unit consists of two identical parts, bolted together with two 1/2-inch bolts. The two halves are held the proper distance apart by the two cylindrical spacers which may be seen in view *A*, Fig. 1.

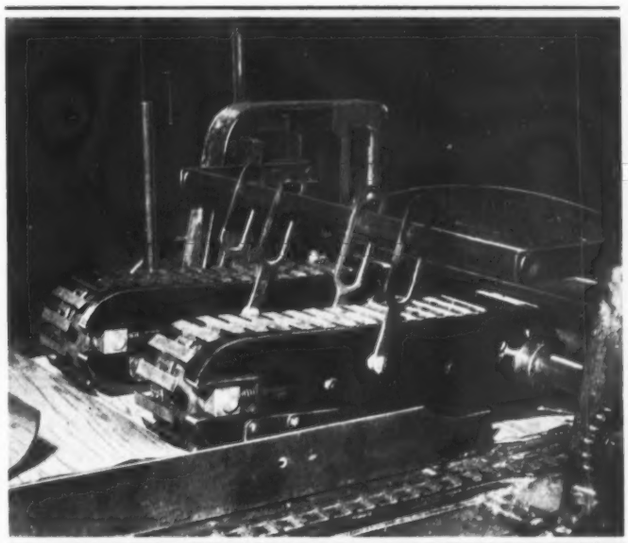


Fig. 2. Wood-strip Feeding Mechanism with Welded Steel Sprocket Housings

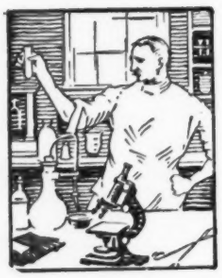
# Wages in Different Countries Compared

A COMPARISON of wages in different countries on a dollars-and-cents basis is always misleading. The only comparisons of any value are those that refer to what the wages received for a given period will buy. A recent number of *Engineering* (London) gives the following figures relating to wages in the United States, England, Germany, and Belgium, and their purchasing power.

To buy a pound of butter, a steel worker in the United States must, on an average, work twenty-six minutes; in England, he must work nearly an hour; in Germany, nearly two hours; and in Belgium, four hours. To earn the price of a pound of sugar, the American steel worker needs less than four minutes; the English, eight minutes; the German, half an hour; and the Belgian, nearly three-quarters of an hour. A pound of beef, again, is earned by the American steel worker in twelve minutes; by the English, in twenty minutes; by the German, in thirty-eight minutes; and by the Belgian, in about two hours.

There is only one reason why American steel companies can pay their workers so much more than foreign producers. That is because more up-to-date machinery is used in American mills, enabling a ton of steel to be produced with a smaller amount of manual labor; and as the figures indicate, labor shares appreciably in the savings.

# MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

## Transparent Bakelite Molding Materials

Transparent phenolic molding materials having a number of distinctive properties, including hardness, heat resistance, dielectric strength, dimensional stability, and light weight, are being introduced on the market by the Bakelite Corporation, 247 Park Ave., New York City. Parts molded from these materials have withstood temperatures up to 225 degrees F. over long periods of time without softening or warping, and in short-time tests, such parts have withstood temperatures of 300 degrees F. without ill effects.

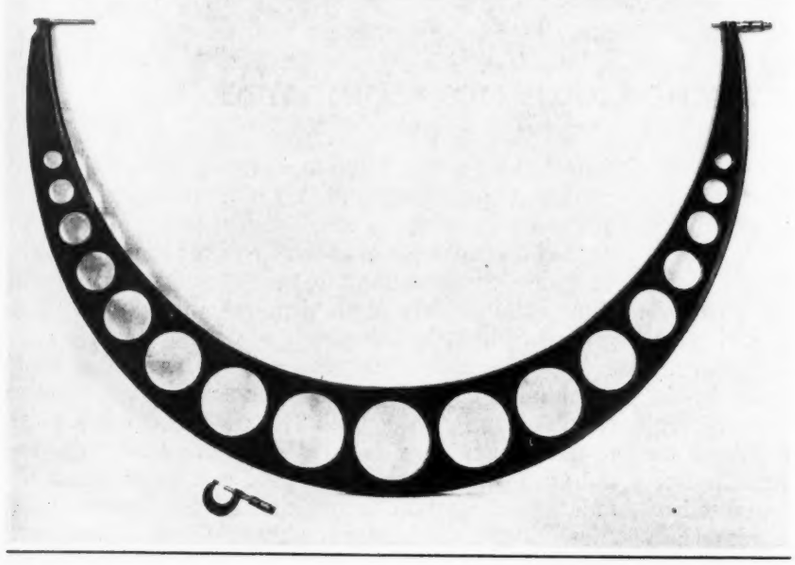
The hardness can be varied over a wide range. This property is particularly important when the material is considered for such applications as traffic signal lights, tail-light lenses for automobiles, and any use in which dust or other abrasive material is likely to come in contact with the part.

These materials can be molded in regular production molds that have been used for general-purpose opaque Bakelite molding materials. While the transparent materials will support combustion, they are relatively non-inflammable. They are about 7 per cent lighter in weight than general-purpose, cellulose-filled phenolic molding materials. Because these new materials are transparent or translucent, it is possible to produce a depth of color and luster that is unusually attractive. One class has such a high index of refraction that its color approaches that of the ruby. The colors available at present include a light shade of amber, ruby, and green. Tortoise-shell, mottled, and cloudy effects can be produced by an admixture of different primary colors.

These molding materials have extreme resistance to the action of intense ultra-violet light under exposures as long as seventy-two hours, which is considered equivalent to one-year's exposure to normal light.

The new transparent materials possess relatively high tensile strength, being more resistant to shock than glass. In resistance to shock, they approach the general-purpose, cellulose-filled Bakelite molding materials.

Transparent molding materials can be used for such applications as automobile tail- and dome-light lenses, elevator signal indicators, instrument housings, containers, furniture drawer-pulls, knobs, handles, gage glasses, electric appliances, lamp-shades, and numerous other parts. . . . . 101



The Versatility of Malleable Iron as an Industrial Material is Indicated by its Use in the Manufacture of Micrometers. The Frames of Both the 1-inch and 46- to 50-inch Micrometers Here Shown, as well as Intermediate Sizes, are Cast of Malleable Iron. The Frames are Tough, Light, and Accurately Shaped



To obtain additional information about materials described on this page, see lower part of page 270.

## Monel Metal Now Available with an Ebony Finish

Research engineers of the Huntington Works of the International Nickel Co., 67 Wall St., New York City, have produced Monel metal with an ebony finish that is obtained through an oxidizing operation. This "Ebonized Monel" is identical with the standard Monel, except for the lustrous blue-black finish, and it can be used for applications in which appearance must be maintained under temperatures up to 1400 degrees F. It has been developed particularly for a newly designed heat deflector used in the Chromalox super-speed range units manufactured by the Edwin L. Weigand Co.

Ebonized Monel is immune to rust, and resists discoloration from relatively high temperatures. It is therefore especially suitable for making reflectors, deflectors, element pans, etc., of electric heating units. .....102

## Recent Developments in Meehanite

One of the outstanding researches in the metallurgy of cast iron has resulted in the special cast iron known as "Meehanite." The metallurgical principle on which this product is based was accidentally discovered by G. F. Meehan in 1923 while working to improve the properties of malleable iron castings. Parallel with this work, similar discoveries were being made in England by Oliver Smalley. In a paper published in 1921, Mr. Smalley showed that both the form and quantity of graphite in cupola cast iron could be accurately controlled, and that, as a result, cast irons with tensile strengths of from 45,000 to 50,000 pounds per square inch could be made. Both Mr. Smalley and Mr. Meehan continued their development work independently until 1926, when they joined forces and formed the Meehanite Metal Corporation, now having headquarters at Pittsburgh, Pa.

Today, Meehanite castings are made according to a number of different specifications for a wide range of purposes. Four distinct groups may be noted: (1) General engineering castings; (2) wear-resisting castings; (3) heat-resisting castings; and (4) corrosion-resisting castings.

In the first group, there are six different grades. According to the grade, tensile strengths from 33,000 to 60,000 pounds per square inch are obtainable. There is also a grade suitable for heat-treatment. This grade may be oil- or water-hardened. A tensile strength of over 70,000 pounds per square inch can be obtained.

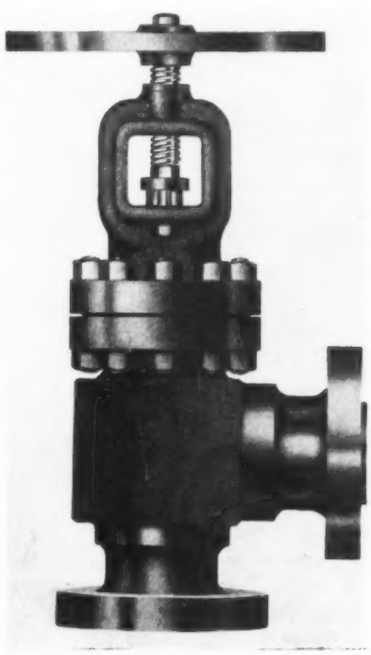
In the wear-resisting castings, there are four grades, known as machineable, non-machineable, chilled, and heat-treated.

In the heat-resisting castings, five different grades are made to meet different temperature requirements. One grade resists temperatures up to 1200 degrees F., while others are made for temperatures up to 1550 degrees F., 1600 degrees F., and 1650 degrees F. A distinct grade is also made to suit requirements where castings are alternately heated and cooled, with resultant expansion and contraction, a treatment that causes mechanical deterioration and breakdown of ordinary iron castings.

The corrosion-resisting castings are also made in different grades to resist, respectively, concentrated acids, acids and chemicals in general, alkalies, and atmospheric corrosion. A distinct grade is made for oil refinery service. .....103

## Extruded Aluminum Shapes for Show-Booth Construction

An interesting feature of this year's automobile show in New York City, aside from the new car models exhibited, was the use of extruded aluminum shapes in the construction of booths and decorations. Two and a half tons of aluminum extruded shapes were used by the Ivel Corporation, New York City, decorators for the exhibition. Ease of erection, rigidity of partitions, and convenient disassembly of these metal frames solved various problems formerly confronted in the erection of display booths. The fact that the shapes can be used repeatedly is another advantage.....104



## Four Different Metals in a New Valve

The body of the valve shown in the accompanying illustration is forged from a single block of chromium-molybdenum steel, and the flanges and bonnets are also forged from the same material. Valves of this type are made by the Clees Valve & Engineering Co., New York City, in sizes from 2 1/2 to 8 inches, for pressures up to 2500 pounds per square inch. They are also made in both angle and offset types.

The valve seats are faced with Stellite, the trim is of stainless steel, and the bolts are produced from Class C steel, A S T M specifications. ..... 105

To obtain additional information about materials described on this page, see lower part of page 270.

# NEW TRADE LITERATURE

***Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 269 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the December Number of MACHINERY***

## Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio. Revised edition of the "Timken Engineering Journal," a 294-page, loose-leaf volume containing a general discussion of the design and types of Timken bearings available, ratings and bearing selection, methods used for calculating bearing loads for a wide range of applications, and complete detailed information on bearing sizes and load carrying capacities. ..... 1

## Aluminum Products

ALUMINUM CO. OF AMERICA, Pittsburgh, Pa. Booklet entitled "Machining Aluminum and Aluminum Alloys," containing information on general machining practice and automatic screw machine practice. Tables are included, giving approximate feeds for standard tools, physical and mechanical properties of aluminum alloys, comparative weights of standard screw machine stock, etc. ..... 2

## Lathe Spindle Noses

LODGE & SHIPLEY MACHINE TOOL CO., 3055 Colerain Ave., Cincinnati, Ohio. Four-page folder illustrating and describing a test made on the new key-drive tapered type lathe spindle nose which has been adopted by many lathe manufacturers. In addition to covering this test, the folder illustrates and describes the new key-drive tapered type spindle nose. ..... 3

## Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Bulletin T-13, containing technical information on nickel and nickel-base alloys and their use in the design of corrosion-resistant machinery and equipment. Bulletin T-14, on the design and construction of heavy equipment in Monel, Nickel, and Inconel. ..... 4

## Stellite

HAYNES STELLITE CO., UNIT OF UNION CARBIDE AND CARBON CORPORATION, 205 E. 42nd St., New York City. Booklet entitled "The Haynes Stellite Library," listing eighteen Haynes Stellite books, reprints, and folders dealing with hard facing alloys, cutting tools, and alloys for chemical processing equipment. ..... 5

## Torsion Dynamometers

ALFRED J. AMSLER & CO., Schaffhouse, Switzerland (United States representative, Herman A. Holz, 167 E. 33rd St., New York City). Bulletin illustrating and describing Amsler torsion dynamometers for measuring the power absorbed by fast running machines and the power developed by fast running motors. ..... 6

## Cutting Oils

SUN OIL CO., Philadelphia, Pa. Catalogue entitled "Cutting and Grinding Facts," illustrating a variety of operations performed on different types of machine tools, and giving the cutting lubricant used in performing the operation, together with other essential data, such as speeds, feeds, etc. ..... 7

## Turret Lathe Tools

GISHOLT MACHINE CO., 1209 E. Washington Ave., Madison, Wis. Catalogue illustrating and describing Gisholt standard tools for 1L and 2L high-production turret lathes, including chucking tools, bar tools, and cross-slide tools, as well as Gisholt chucks, boring-bars and machine attachments. ..... 8

## Compensated Belts

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., 34 Townsend St., Passaic, N. J. Four-page bulletin descriptive of the principle of action and the advantages of Condor compensated belts. Data is also given on the proper selection, application, and supervision of these belts. ..... 9

## Chucks

CUSHMAN CHUCK CO., Hartford, Conn. Catalogue 50, covering the complete line of chucking equipment made by this concern. Large-scale blueprints and full dimension data are included for all chucks and component parts, which should be of value to design engineers and engineering departments. ..... 10

## Indicating and Controlling Instruments

WHEELCO INSTRUMENTS CO., 1929 S. Halsted St., Chicago, Ill. Bulletins 602 and 650, illustrating and describing, respectively, the Wheelco Capacitrol, an automatic temperature control instrument, and the new Wheelco proportioning indicating controller. ..... 11

## Die and Mold Duplicators

GEORGE GORTON MACHINE CO., 1109 Thirteenth St., Racine, Wis. Bulletin 1319-B, covering the line of die and mold duplicators made by this company. Examples of the use of the duplicators on die-casting dies, drop-forging dies, plastic molds, glass molds, etc., are illustrated. ..... 12

## Alloy and Carbon-Steel Socket Wrenches

J. H. WILLIAMS & CO., 75 Spring St., New York City. Booklet entitled "How to Select and Use Wrenches," containing much helpful information both for the mechanic and the tool buyer on wrench types and their applications. ..... 13

## Lighting Equipment

BENJAMIN ELECTRIC MFG. CO., Des Plaines, Ill. Catalogue 26, containing 352 loose-leaf sheets of data on the Benjamin line of lighting equipment, as well as engineering recommendations, floor lay-out plans, lighting efficiency curves, installation illustrations, etc. ..... 14

### Electrolimit Mill Gages

PRATT & WHITNEY, DIVISION NILES-BEMENT-POND CO., Hartford, Conn. Catalogue entitled "Controlled Strip Thickness," describing the application of Pratt & Whitney electrolimit continuous gages, classifier gages, and strain gages in the steel industry. ..... 15

### Gear-Lapping Machines

NATIONAL BROACH & MACHINE CO., Shoemaker and St. Jean Sts., Detroit, Mich. Circular entitled "New Red Ring Gear-Lapping Machine," illustrating and describing the characteristics and application of this machine. ..... 16

### Conveyor Chain

LINK-BELT CO., 220 S. Belmont Ave., Indianapolis, Ind. Folder 1651, on No. 4250 swivel chain, which will travel around curves of as small a radius as 12 inches, and is particularly suitable for case, crate, and can conveyors. ..... 17

### Stainless-Steel Electrodes

PAGE STEEL AND WIRE DIVISION OF AMERICAN CHAIN & CABLE CO., INC., Monessen, Pa. Booklet on stainless-steel electrodes, containing information regarding the various grades of stainless steels and the procedure for welding them. ..... 18

### Tube Couplings

PACKLESS METAL PRODUCTS CORPORATION, 37-14 Twenty-ninth St., Long Island City, N. Y. Bulletin 500, containing specifications and data sheets covering Packless self-flaring tube couplings for quick assembly, even in inaccessible places. ..... 19

### Safety Apparel

INDUSTRIAL GLOVES CO., 752 Garfield Blvd., Danville, Ill. Catalogue of "Steel Grip" safety apparel, illustrating widely used hand and body guards, such as gloves, mittens, aprons, leggings, etc., for the prevention of injuries. ..... 20

### Electrical Products

COLT'S PATENT FIRE ARMS MFG. CO., Electrical Division, Hartford, Conn. Catalogue 60, covering the line of electrical products made by this concern, including safety switches, fuses, industrial control equipment, etc. ..... 21

### Stiffness Testers

TINIUS OLSEN TESTING MACHINE CO., 500 N. 12th St., Philadelphia, Pa. Bulletin 11, illustrating and describing a new line of Olsen stiffness testers applicable to a variety of materials, including sheet metal, wire, plastics, etc. ..... 22

### Portable Electric Tools

SKILSAW, INC., 3310 Elston Ave., Chicago, Ill. Catalogue 38, covering the Skilsaw line of portable electric tools for production, maintenance, and construction, including hand saws, drills, grinders, sanders, and blowers. ..... 23

### Salt Baths for Heat-Treating

E. F. HOUGHTON & CO., 240 W. Somerset St., Philadelphia, Pa. Bulletin entitled "Liquid Salt Baths," describing new liquid salts for the heat-treating of high-speed steel, and giving details concerning the treatment. ..... 24

### Electric Motors

RELIANCE ELECTRIC & ENGINEERING CO., Ivanhoe Road, Cleveland, Ohio. Bulletins 122 and 124, describing, respectively, splash-proof Type AA Reliance motors, and explosion-proof Type AA alternating-current motors. ..... 25

### Heat-Treating Furnaces

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Circular illustrating Homo tempering furnaces, and describing two typical applications on different classes of work in actual production. ..... 26

### Speed Control Units

REEVES PULLEY CO., Columbus, Ind. Circular illustrating and describing the Reeves "Motodrive," which provides any driven machine with an infinite number of speeds without stopping production. ..... 27

### Stamping Dies

MATTHEWS OF NEW YORK, 480 N. Canal St., New York City. Circular entitled "The Story Behind Matthews... 'Tuf-Face' Steel Stamps and Dies." ..... 28

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## To Obtain Copies of New Trade Literature

**listed on pages 268-270 (without charge or obligation) mark with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:**

## MACHINERY, 148 Lafayette St., New York, N. Y.

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### Horn Presses

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Bulletin 60-C, illustrating and describing the latest improvements and developments in the complete line of Niagara horn presses. ....29

### Materials-Handling Equipment

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D. O. JAMES MFG. CO., 1114 W. Monroe St., Chicago, Ill. Catalogue covering the line of gears and speed reducers made by this company. Complete engineering data is included. ....33

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GENERAL ELECTRIC CO., Schenectady, N. Y. Catalogue GEA-2447C, descriptive of the Mutator arc welder for fabricating and repairing light-gage metal. 35

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BOSTON GEAR WORKS, INC., Hancock and Hayward Sts., North Quincy, Mass. Leaflet containing data on "Noelting Faultless" casters for industrial use. ....38

### Hacksaw Blades

W. O. BARNES CO., INC., Detroit, Mich. Booklet on Barnes hacksaw blades, containing dimensions of hand and power blades, and helpful information on their use. ....39

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## To Obtain Additional Information on Shop Equipment

**Which of the new or improved equipment described on pages 271-287 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 271-287—or write directly to the manufacturer, mentioning machine as described in December MACHINERY.**

| | | | | | | | | | | | | | | | | | | | | |
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**[SEE OTHER SIDE]**

# *Shop Equipment News*

*Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market*

## Bardons & Oliver Geared Electric Turret Lathe

Round bar stock up to 1 inch in diameter can be fed through the spindle of a high-speed No. 2 geared electric turret lathe recently brought out by Bardons & Oliver, Inc., Cleveland, Ohio, to provide in a small-capacity machine the high-production features of larger turret lathes. This new machine has a swing of 13 1/2 inches and is adapted for machining brass, aluminum, and other non-ferrous metals, as well as steel and small iron castings.

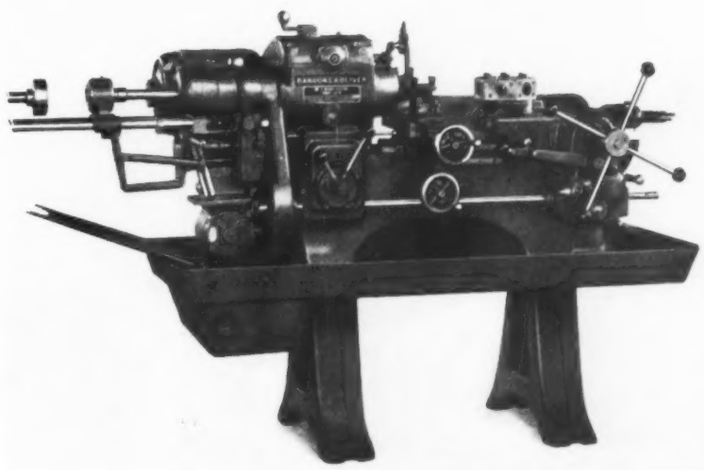
The head is designed around a high-torque, quick-reversing motor of the flange-mounted type which drives through a train of gears that slide on splined shafts. Clutches have been eliminated and gears and shafts made as light as consistent with good design, so as to reduce the inertia as much as possible and enable the maximum number of reversals to be made per minute. Instantaneous reversing is accomplished electrically by operating a hand-lever below the head on the front of the machine, which actuates a magnetic reversing switch.

Six spindle speeds are obtainable with a single-speed motor by operating a single lever on top of the headstock. Speeds are indicated by a direct-reading dial. Double this number of speeds can be obtained with a two-speed motor, in which case instantaneous speed changes in the ratio of 2 to 1 can be made by means of the lever mounted in front of the reversing lever. In this way, turning and facing operations can be followed with tapping or threading operations, or vice versa.

The turret-slide has an effective movement of 7 inches. The saddle apron provides six power feeds to the turret-slide, ranging from 0.0035 to 0.033 inch per revolution. Feeds are changed by operating a single lever and are indicated on a dial. A hand-operated pump on the side of the saddle apron lubricates all important bearing surfaces not reached by the splash system, including the slide and saddle ways. The bearing surface on the bottom of the turret-slide and the corresponding surface on the saddle are fitted with hardened and ground wear strips of alloy steel with a view to insuring vertical alignment of the turret during the lifetime of the machine. The machine can be supplied without the turret-slide power feed for light work.

Three different cross-slide and carriage units may be furnished to meet requirements. There is a hand screw feed for average work, such as facing and cutting off steel or cast iron, a lever feed for high-speed operation on non-ferrous metals, and a combined screw and lever feed that enables the operator to select the particular type of feed best suited for the job. Disk and latch type stops behind the cross-slide handwheel permit quick duplication of diameters, and both the cross-slide and the carriage are equipped with large micrometer dials.

Ratchet and finger type hand-operated bar-feeding mechanisms are available. With the ratchet type, the bar is supported in a two-jaw chuck, mounted in anti-friction bear-



Bardons & Oliver Electric Turret Lathe, Motor-driven through Sliding Gears

To obtain additional information on equipment described on this page, see lower part of page 270.

ings. The supporting head slides concentrically with the spindle on two horizontal bars. In the finger bar-feed, a feed-finger grips the bar directly behind the collet, feeds the bar forward, and returns to its starting position as the collet is closed.

Another feature of this machine, intended for use in semi-automatic operation, is an electric power operated automatic chuck and bar feed which can be provided in place of the regular type of automatic chuck and bar feed. ..... 51

## Cincinnati Heavy-Duty Frog and Switch Planer

A "Hypro" heavy-duty planer recently brought out by the Cincinnati Planer Co., Cincinnati, Ohio, for use in machining railway frog and switch products is furnished in two standard widths with a distance between the housings of 42 and 48 inches. The maximum height under the cross-rail of the machine is 24 1/2 inches.

The cross-rail can be permanently located on the housings by dowel-pins or, if necessary, power elevation of the cross-rail can be provided by mounting a five-horsepower motor on the top of the machine. Each rail-head has an independent feed-screw, and is operated from the right-hand side of the machine.

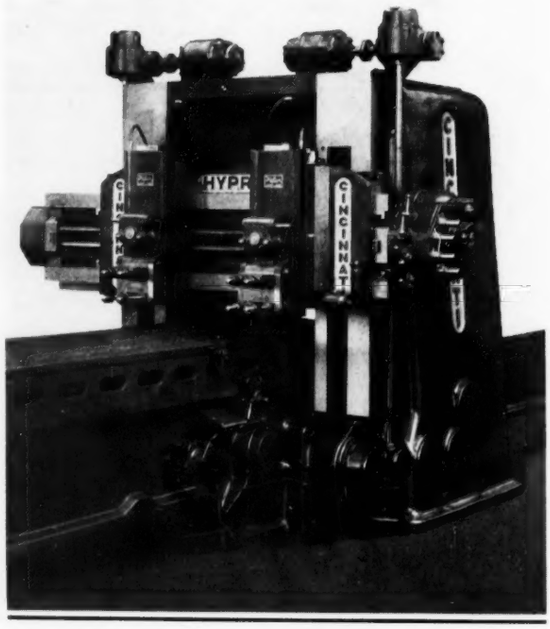
Automatic feeds ranging from 1/96 to 9/16 inch are available for both the downward movement of the slides and the crosswise movement of the saddles. The main reversing driving motor has a capacity of from 50 to 75 horsepower, and the minimum cutting speed is approximately 16 feet per minute. The tools can be quickly positioned by means of the rapid-traverse vertical and horizontal movements obtained through drives from motors mounted on the top of the machine. These motors are controlled by reversing switches on the right-hand side of the machine.

Pneumatically operated lifters relieve the cutting tools from wear on the return stroke of the table. The tool-block is designed so as to relieve the clapper-box taper pin from upward bending strains. Angular adjustment of the tool is obtained by a worm which engages worm-wheel teeth cut in the solid tool-block. Forced lubrication is furnished for all bearings, including the table V-ways. ..... 52

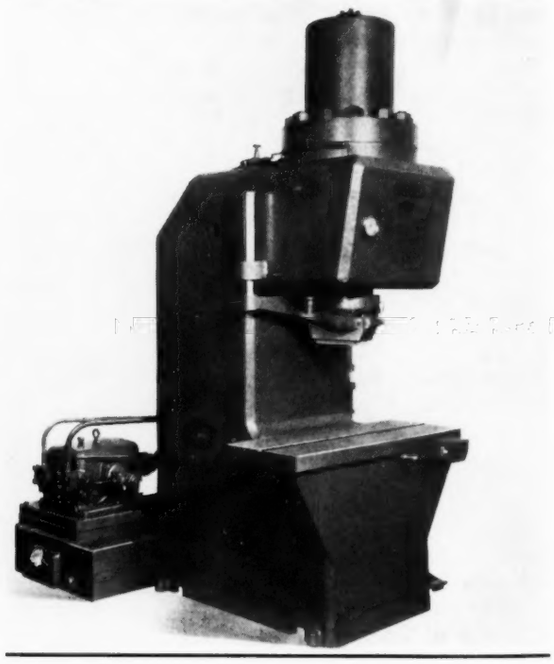
## Oilgear 200-Ton Gooseneck Straightening Press

Front-axle I-beams for heavy trucks and buses are straightened on a 200-ton gooseneck straightening press recently brought out by the Oilgear Co., 1302 W. Bruce St., Milwaukee, Wis. The frame and motor mounting of this press are constructed of steel plates, welded together into a single unit and normalized. Plates up to 3 inches in thickness are used in the main section of the frame, which weighs 12,800 pounds and required the use of over 1100 pounds of welding rod in its fabrication.

The complete press weighs about 19,000 pounds, is 120 inches high, and occupies a floor



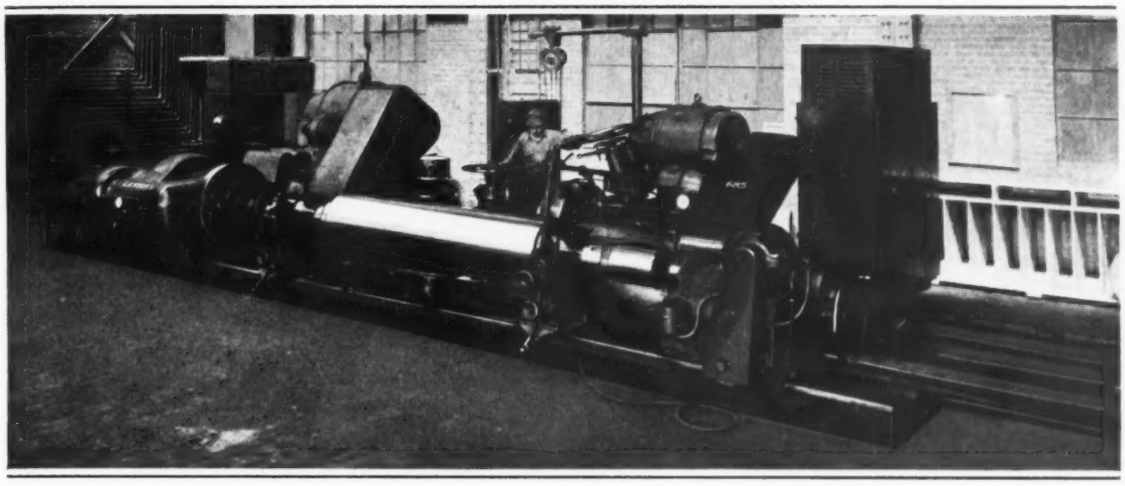

Cincinnati Heavy-duty Planer, Built Primarily for Machining Railway Frog and Switch Products



Gooseneck Straightening Press of 200 Tons Capacity Brought out by the Oilgear Co.



To obtain additional information on equipment described on this page, see lower part of page 270.



Landis Roll-grinder with Finish-grinding and Rough-grinding Carriages

space of 72 by 88 inches. The maximum stroke is 12 inches; the distance from the end of the ram to the table, 26 inches; depth of throat, 12 inches; width of table, 18 inches; length of table, 50 inches.

Tests indicate that the maximum deflection of the ram at its center line under full tonnage is only 0.025 inch. Accurate straightening of parts between centers or on V-blocks is facilitated by the sensitive control, which enables the operator to bring the ram into contact with the work without impact and to deflect the piece the desired amount without over-running.

Fluid power up to 2500 pounds per square inch is supplied by an Oilgear two-way variable-displacement pump driven by a 15-horsepower direct-connected electric motor operating at 1200 revolutions per minute. When higher production is required, greater operating speed can be obtained by changing to a larger pump, which provides a maximum ram speed downward of 38 inches per minute and a maximum ram speed upward of 76 inches per minute at pressures up to 2500 pounds per square inch.

The hydraulic control on the pump is operated by the hand-lever or foot-pedal through a simple spring-loaded control mechanism. The operator can start, accelerate, decelerate, or reverse the ram instantly.....53

## Landis Roll-Grinder with Separate Carriages for Roughing and Finishing

The dual wheel-carriage roll-grinder shown in the accompanying illustration was brought out recently by the Landis Tool Co., Waynesboro, Pa., to meet rather unusual roll grinding requirements of a large manufacturer. The rolls ground on this machine are of chilled iron containing a high percentage of nickel, and show a scleroscope reading of 80 to 85. The machine is 36 inches by 18 feet and is designed to rough-grind the rolls and then finish-grind them without a preliminary turning operation.

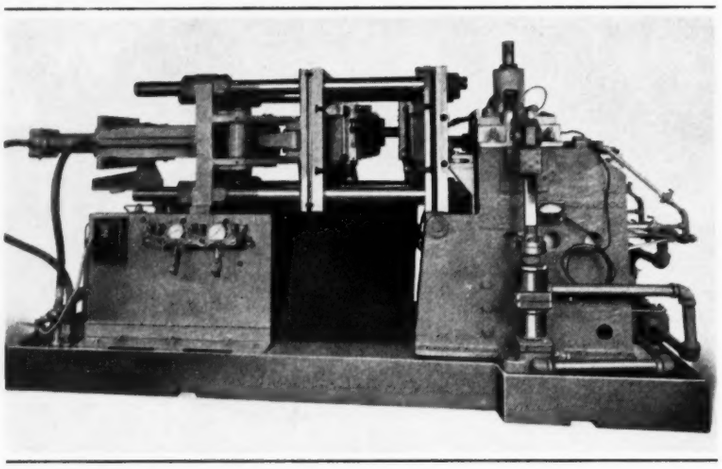
On the rear section of the machine are two grinding wheel carriages. The conventional wheel carriage shown to the right is used for the finishing operation, while the other carriage carrying a wheel-head of unusual design is used for the roughing operation. The exceptional length of the rear bed permits the finishing wheel carriage to be run out to the end of the bed, so that the second carriage can be used for rough-grinding without interference. The rough-grinding wheel carriage can then be run to the opposite end of the bed while the finish-grinding carriage is in operation.

The roughing wheel is 36 by 12 by 18 inches in size and consists of two 36- by 6- by 18-inch wheels, mounted in contact with each other at the center of the wheel-spindle, the wheels being carried between the spindle bearings. The combined wheel is driven by multiple V-belts from the 100-horsepower motor on the rear of the head.

In grinding a roll 79 inches long which has a diameter of 25 inches, 0.150 inch of stock is removed at the rate of 8 cubic inches per minute under continuous production conditions. One of the advantages claimed for this new machine is a reduction in grinding wheel costs to about half that of previous costs. Another advantage is that only one handling of the work is required to complete both roughing and finishing operations. With this machine, the body of the roll can be ground straight, concave, or convex. The roll necks can also be ground. No wheel dressing is required for the roughing wheels, as they break down properly during grinding.

Thirteen electric motors developing a total of more than 224 horsepower are utilized in operating the machine. All motors can be controlled from the wheel carriage that is in use. The work-drive motor rheostat has a motor-driven remote control that permits it to be controlled from the operator's platform on the wheel carriage. Neither wheel carriage motor can be started while the other is in operation.....54

To obtain additional information on equipment described on this page, see lower part of page 270.



Hydraulic Die-casting Machine Built by the Kux-Lohner Machine Co.

## Kux-Lohner Hydraulic Die-Casting Machine

A hydraulically operated die-casting machine for casting lead, zinc, or aluminum alloys has been brought out by the Kux-Lohner Machine Co., 2147 Lexington St., Chicago, Ill. This machine is equipped with a plunger constructed to take up wear without sticking and to retain its ability to withstand pressure even after wear.

The machine is so designed that no strain is put on the furnace and metal pot. A heavy bridge construction supports the plunger gooseneck, which can be easily adjusted to obtain a good contact of the nozzle with the die. The hydraulic ram which operates the plunger is placed on the side of the machine to remove it from the heated area.

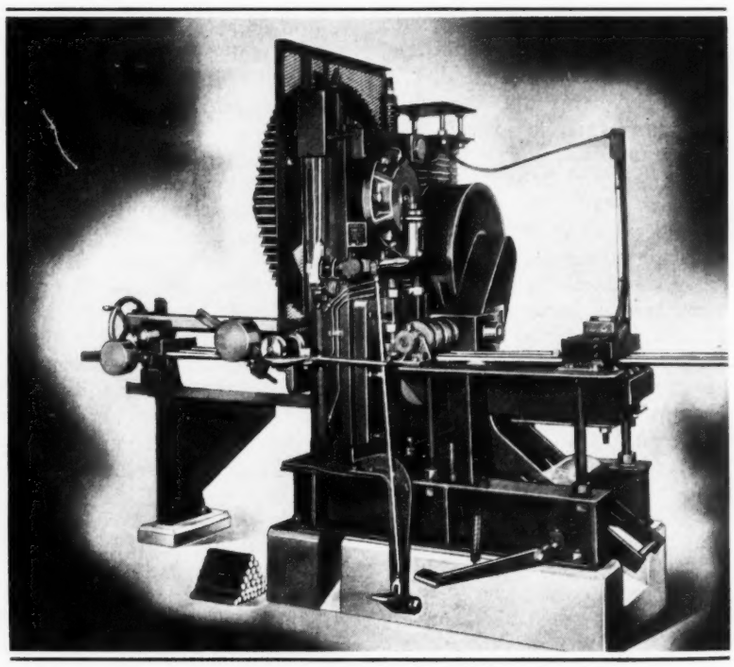
A particular feature of the machine is an adjustable core-pulling mechanism which can be located to pull cores at any angle and at any position on the die. It will pull cores from either the stationary or movable half of the die. The hydraulic pressure control of this machine has been designed for simplicity and safety. Each phase of the casting cycle must be completed before the next one can start. Interlocking manual controls prevent the operator from making mistakes in moving the control levers. The machine is a complete self-contained unit requiring no air compressor, except for aluminum casting, and is ready for casting zinc and lead as soon as gas, water, and electric connections are made.

This machine is built in three sizes, with a distance between bars of 12, 18, and 24 inches. Any of these machines can be converted from the plunger type used for zinc and lead castings to the air injection type used for aluminum castings. ..... 55

## Buffalo Automatic Shear for Bolt and Rivet Stock

A high-speed machine for the continuous shearing of bar stock for bolts and rivets has been developed by the Buffalo Forge Co., Buffalo, N. Y. This machine is equipped with automatic feed-rolls that grip and pull the stock into the shear only when the knives are open on the "up" stroke. They release their grip the instant the stock touches the rear gage and the top knife starts to descend, thus eliminating marring of the stock.

A specially designed roll automatically adjusts itself to any ordinary irregularities in the bar stock. Three bars are fed and sheared at one time, at the rate of thirty strokes per minute, giving a total production of over 5000 sheared pieces per hour. The tilting type gage at the rear of the machine is easily adjusted for any length of bolt up to 18 inches for automatic feed and 48 inches for hand feed. A cropping gage is provided for cutting off one inch on each bar at the start of a run to secure a square end. This gage is automatically withdrawn after the first cut. ..... 56



Buffalo Shear for Cutting off Bolt and Rivet Stock



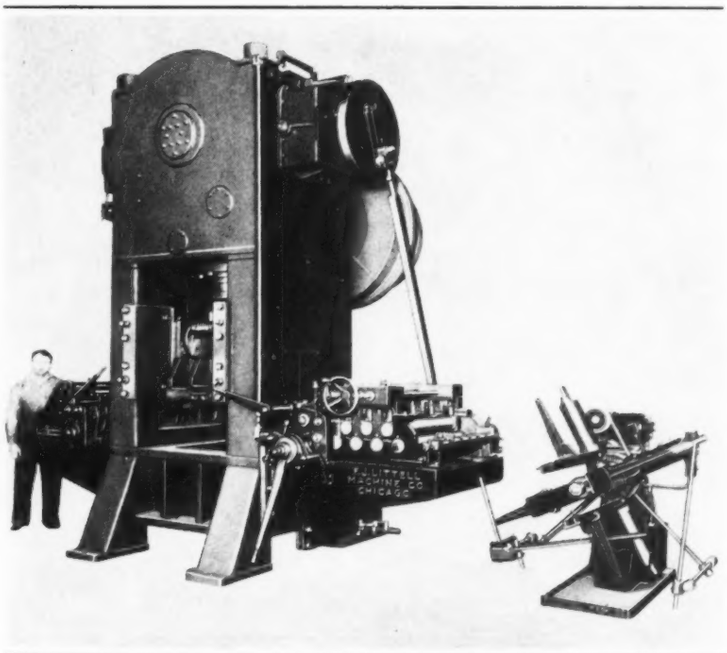
To obtain additional information on equipment described on this page, see lower part of page 270.

## Littell Roll Feed, Scrap-Cutter, and Reel for Large Press

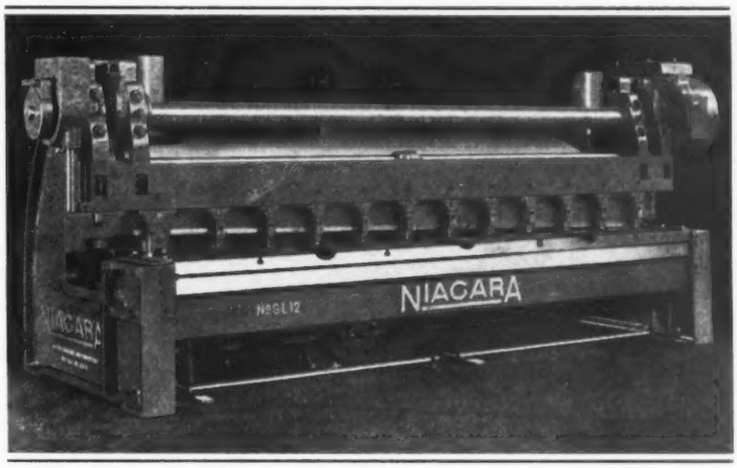
The large press shown in the accompanying illustration was recently equipped with a double rack-and-pinion roll feed, power-driven straightener, scrap-cutter, and reel, by the F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill., for one of its customers. The feed has rolls 7 1/3 inches in diameter by 30 inches wide, and was built to handle hard aluminum stock 0.102 inch thick by 27 inches wide in coils, and strip stock 1/4 inch thick by 27 inches wide. This aluminum stock is very stiff, and has a tensile strength of 60,000 pounds per square inch.

The machine is equipped with an automatic release brake and will feed at the rate of 1200 inches per minute. The straightening rolls are 4 inches in diameter by 30 inches wide. The long lever on the right-hand side provides for "ratcheting" the stock ahead in starting a new coil. The two short levers at the right and left are used to raise the rolls when necessary.

The feed is equipped with automatic lifters, so that the feed-rolls on both sides of the press can be lifted at each stroke to permit adjusting the stock. The heavy-duty scrap-cutter is operated by the crankshaft of the press. The power-driven automatic centering reel shown at the right is designed to wind off a loop, so that the feed-rolls do not pull directly from the coil, but from the loop. ..... 57




Press with Littell Roll Feed, Straightener, Scrap-cutter, and Reel




Niagara Power Squaring Shears, Built in Lengths from Six to Sixteen Feet

## New Series of Niagara Power Squaring Shears

Power squaring shears in a Series SL have been brought out in 6-, 8-, 10-, and 12-foot lengths by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., for the flat shearing of steel 3/16 inch thick, and in 14- and 16-foot lengths for No. 10 gage steel.

The shears of this series are made with a triangular-section cross-head having a low slope. The enclosed drive is mounted in anti-friction bearings that run in oil. The shears are equipped with a fourteen-point engagement sleeve clutch having a built-in single-stroke mechanism. Alloy steel knives are another feature. ..... 58

## General Electric Crane-Hoist Control

A direct-current crane-hoist control developed to insure rapid and safe lowering has been brought out by the General Electric Co., Schenectady, N. Y. Rocker-bearing contactors and magnetic time-relays, such as are employed satisfactorily in steel mill service, are used in this control. High lowering speeds, precise speed regulation and spotting of the hoist hook, protection of both motor and brake from abuse, and maximum

To obtain additional information on equipment described on this page, see lower part of page 270.

safety for the operating crew are features claimed for this equipment.

Power consumption is lessened by employing regenerative braking. Dynamic braking is also available for emergency stops, should failure of the solenoid brake occur. Automatic control of deceleration by a magnetic time-relay provides safe stopping of loads when lowering. Magnetic time-relays are employed to control acceleration both when hoisting and lowering loads. The accelerating and decelerating relays are independently adjustable. ..... 59

## Fellows Rack Shapers and Hourglass-Worm Thread Generator

Two new rack shapers and an hourglass-worm thread generator have been brought out by the Fellows Gear Shaper Co., Springfield, Vt. The two rack shapers cut both spur- and helical-tooth racks, and are identical, except that the one designated No. 3-48 will cut racks up to 48 inches in length with a face width of 3 inches, whereas the one known as No. 3-60 will cut racks up to 60 inches in length.

The table of the rack shaper is actuated by a lead-screw and change-gears. The cutter-head is mounted on a base located at right angles to the table. The position of the head when the cutter is in operation is controlled by a feed-cam which, in conjunction with change-gears, controls the depth of cut and the depth feed per stroke of the cutter. The saddle carrying the cutter-spindle is of the "relieving" type, and is mounted on trunnions supported in the bed which are actuated by a positive relieving mechanism.

The machine has complete electrical control, comprising push-buttons and selector switches which can be set to start the cutter at either end of the rack or at its center. The switches can also be set for controlling the depth of feed and traverse feed motions, as well as for stopping the machine when the rack is completed.

A rack can be finished automatically in either one or two cuts without any attention on the part of the operator. The machine is equipped with four motors: The main motor which operates the cutter-spindles, etc.; compound pump motor; depth-feed motor; and traverse-feed motor.

The hourglass-worm thread generator, shown in Fig. 2, employs a cutting head of the "swinging" type, which is operated by the cam arrangement shown in Fig. 3. This machine is intended for high-production work, and is arranged with automatic electric control to facilitate operation. It is designed for quick removal and insertion of the work. The method of presenting the cutter to the work has been developed to insure accurate and smoothly finished worm threads. The work is usually held between cones, one on the stub driving-arbor in the headstock, and the other on the tailstock center. The cutter is kept in step with the threads on

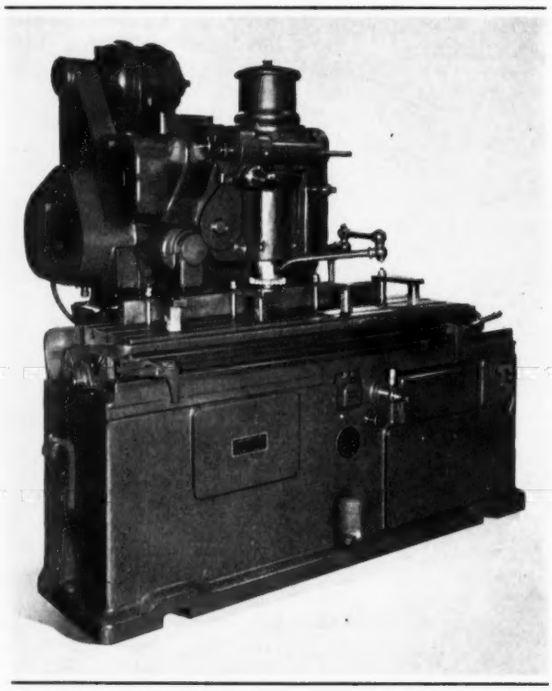


Fig. 1. Fellows Automatic Rack Shaper which Cuts Spur or Helical Teeth

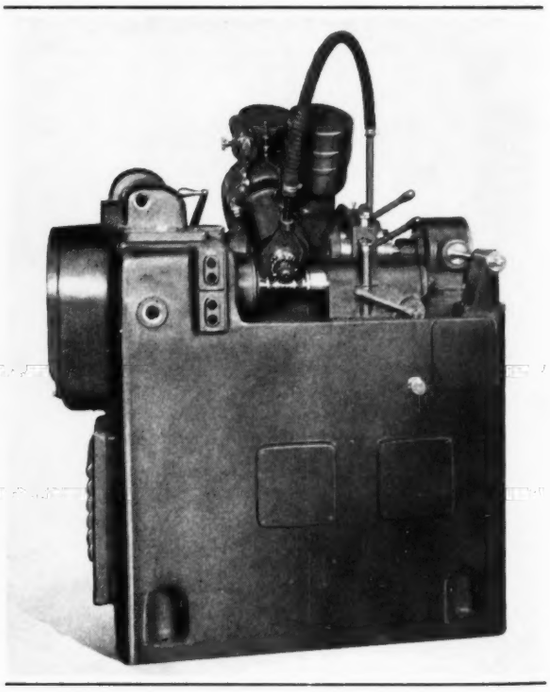


Fig. 2. Fellows Thread Generator for Producing Hourglass Steering Worms



To obtain additional information on equipment described on this page, see lower part of page 270.

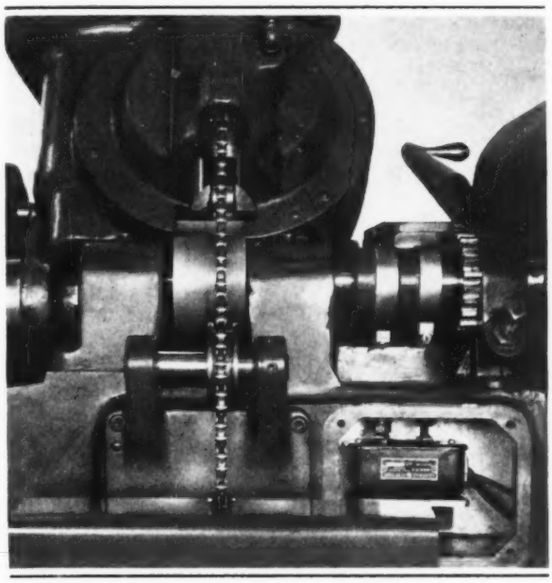


Fig. 3. Close-up View of Depth-feed Cam, Starting Lever, and Switch of Machine Shown in Fig. 2

Precision Threading Machine for Duplicate Parts, Built by the Geometric Tool Co.

the work through feed-gears and is fed down directly into the work, the rate of feed per revolution being governed by the rise on the feed-cam in conjunction with feed-gears.

The cutter-head is automatically elevated when the worm is finished, to permit removing and inserting the work. Most of the stock is removed with a fairly coarse feed, after which the feed is reduced for the remaining cut, the cutter finally dwelling for several revolutions without any down feed in order to produce a smooth finish on the work. ..... 60

## Metasap Lubricant for Drawing Steel Wire

A lubricant for the dry drawing of steel wire has been developed by the Metasap Chemical Co., a subsidiary of the National Oil Products Co., Harrison, N. J. This lubricant, known as "Metasap DP," is a fine white powdery material having a melting point of 302 degrees F. It is claimed that cleaner and brighter wire of more uniform size is obtained when this lubricant is used, and that the drawing dies have a longer life. ..... 61

## Geometric Threading Machine

The Geometric Tool Co., New Haven, Conn., has just placed on the market the light-weight No. 14 threading machine here illustrated. This machine is intended for the precision threading of duplicate parts. It will cut standard pitches up to 9/16 inch, and fine pitches in larger sizes. Either a Style KD die-head with conventional milled or tapped chasers or a Style TR die-head with tangent or circular chasers can be employed.

A feature of this machine is the wide range of work-holding devices it will accommodate. Either a standard two-jaw vise or a standard collet chuck is regularly furnished. For simple jobs, the user can purchase the machine without the work-holder and mount a holder of his own design on the machine platen. Both the standard vise and the standard collet chuck can be adjusted for alignment. Vertical and horizontal adjustment of the work-holder can be readily accomplished without the use of gibs or shims.

The illustration shows the machine equipped with the standard two-jaw vise. The automatic gage for properly setting the work swings out of the way when the vise jaws are tightened on the work. Pick-off change-gears provide a wide range of threading speeds to suit different diameters and materials. The drive is by a double V-belt from a motor mounted in the base. Coolant is supplied by an automatic reversible pump. ..... 62

## GE Portable Welder with Gasoline-Engine Drive

A single-operator, portable arc-welding generator, driven by a standard 60-horsepower Ford V-8 engine, has been brought out by the General Electric Co., Schenectady, N. Y. This welder has been designed to permit successful arc welding where electric power line service is not available. It has a 200-ampere, 40-volt arc rating. The complete unit is 24 inches wide, 60 inches long, and 43 inches high, and can be loaded crosswise into practically any truck body. The net weight is approximately 1250 pounds.

Duplex control gives the choice of current and voltage adjustments essential to best work under varying conditions. The self-

To obtain additional information on equipment described on this page, see lower part of page 270.

stabilization characteristic of the generator permits easy welding with any type of wire, either bare or shielded arc, and with any current or voltage adjustment. Less than two gallons of fuel per hour will operate the machine at full load. The equipment of the standard welder includes an electric self-starter, battery-charging generator, oil-bath air cleaner, fuel pump, 10-gallon fuel tank, and vacuum speed-governor. ..... 63

## Sellers Unit-Head Table Type Horizontal Boring, Drilling, and Milling Machine

A table type horizontal boring, drilling, and milling machine with the unit type of spindle head provided on the floor type machine shown in November MACHINERY, page 214, has been brought out by William Sellers & Co., Inc., 1600 Hamilton St., Philadelphia, Pa. The machine shown is equipped with a table 60 by 120 inches. The spindle head has a 5-inch spindle, and the spindle feeding stroke on the machine illustrated is 36 inches. The maximum distance from the center of the spindle to the top of the table is 60 inches.

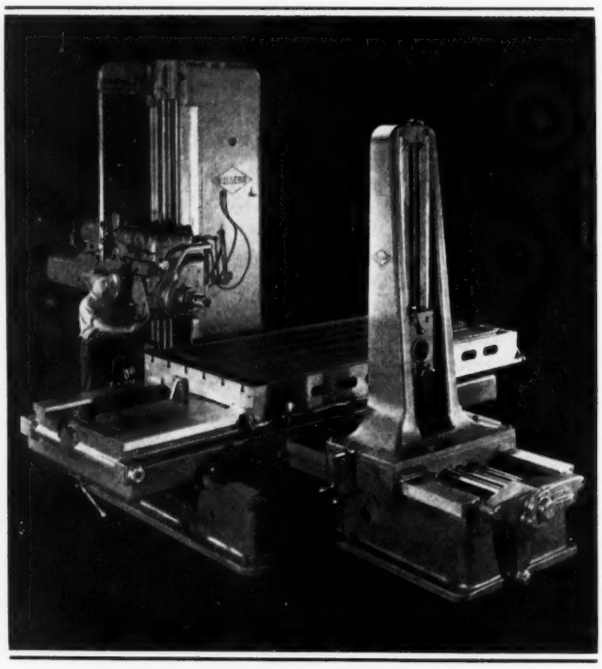
The table has a cross-feed of 108 inches, and the distance from the top of the table to the ways on the bed is 16 inches. The width of the bed across the ways is 108 inches, and the maximum distance from the faceplate to the outboard support is 10 feet.

There are twenty-four spindle speeds ranging from 5.8 to 334 revolutions per minute, and twenty-four feeds to the spindle, head, table, and saddle of from 0.0025 to 0.625 inch per revolution of the spindle. Precision measuring equipment, consisting of two sets of dial indicators, a micrometer, and V-bars with adjustable stops for pin gages, is supplied. The coolant system has a motor-driven pump, and the chip pan is supported by pins in the saddle. The machine is driven by an alternating-current 15-horsepower motor having a speed of 1750 revolutions per minute. ..... 64

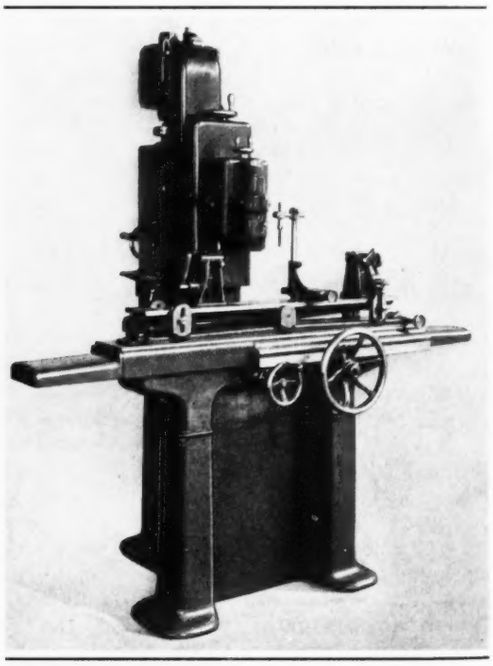
## Cutter and Reamer Grinding Machine

The No. 1 universal cutter and reamer grinding machine made by the Union Twist Drill Co., Athol, Mass., is now available in a motor-driven type. The drive is furnished by a one-horsepower motor having a speed of 1800 R.P.M. The motor is connected directly to the rear drum shaft by a flexible coupling.

This machine is designed for sharpening straight or spiral milling cutters, face mills, end-mills, and straight or taper reamers. It will grind on centers a cutter 12 inches in diameter or a reamer 24 inches long, using a cup form of wheel which gives a flat clearance surface. The table is mounted on roller bearings, and is reciprocated by means of a rack, pinion, and handwheel. The machine weighs about 1500 pounds, and requires a floor space of 35 inches by approximately 97 inches. ..... 65



Sellers Unit-head Table Type Horizontal Boring, Drilling, and Milling Machine



Union Twist Drill Co.'s Motor-driven Cutter and Reamer Grinder



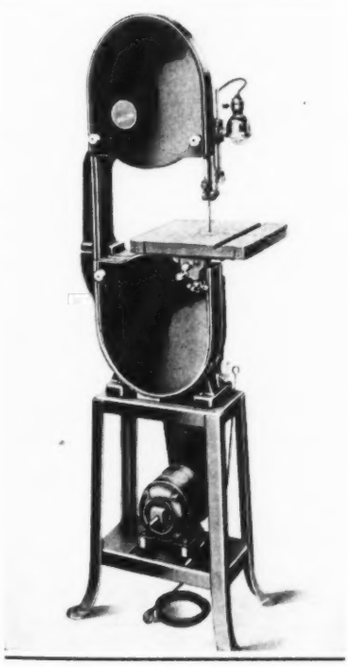
To obtain additional information on equipment described on this page, see lower part of page 270.

## Delta Metal-Cutting Band Saw

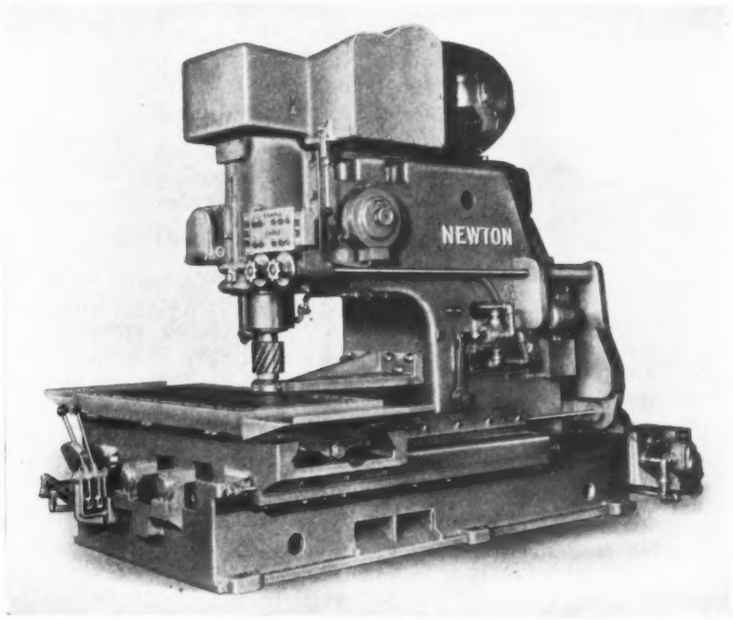
Materials up to 6 inches thick can be handled by a metal-cutting band saw recently brought out for general shop use by the Delta Mfg. Co., 627 E. Vienna Ave., Milwaukee, Wis. With an extension attachment, the capacity under the guide can be increased to 12 inches. The depth of the throat from the band saw to the frame is 14 inches.

This saw can be operated at speeds of 125, 175, 250, and 340 feet per minute for cutting metal, and at 2200 feet per minute for cutting wood. The slow speeds are obtained through a ball-bearing gear-box, and the fast speed direct from the motor through a V-belt drive. New Departure self-sealing ball bearings are used throughout to eliminate the necessity of lubrication.

This machine can be used for cutting templets, sawing jig and fixture bases or similar parts, fitting light structural sections and extruded shapes, sawing sheet-metal and plastics, and for many other purposes. ..... 66



Delta Band Saw with Slow and Fast Speeds




Newton Heavy-duty Profile Milling Machine for Radius Links and Similar Work

## Newton Heavy-Duty Profile Milling Machine

A heavy-duty vertical profile milling machine adapted for the profile-milling of radius links, eccentric cranks, link cheeks, and similar castings and forgings has been developed recently by the Newton Division of the Consolidated Machine Tool Corporation, Rochester, N. Y. Simplicity of control and the ease of longitudinal and transverse table movements in taking heavy cuts are features of this machine.

Two levers at the front of the machine control the rate of feed and the rapid traverse. One lever controls the saddle and the other the table. Movements of the saddle and table are accomplished by hydraulic screw feed and controlled by banks of push-buttons mounted at the front of the machine. Hand control of the table and saddle feeds is provided by dials which operate through follow-valves.

When the hand feed is used, the table travels only as far as indicated by the dial position, and at a rate that can be instantly set or changed by means of the two levers previously mentioned. Either or both movements of the table may be operated by a power feed, the rates being varied as required.

A variable-speed motor, mounted on the head, drives the spindle through a V-belt and quick-change gears, giving a wide range of spindle speeds. Anti-friction bearings are used throughout the drive, and all gears are enclosed and run in oil.

The work can be clamped directly to the table without the use of fixtures. One hydraulic pump connected to two hydraulic motors actuates the table and cross-slide. The feed drive gears are fully enclosed and run in oil, while lubrication of the bearings is furnished by a centralized oiling system.

The machine shown in the illustration has a work-table 27 by 60 inches, with an in-and-out travel of 30 inches and a longitudinal travel of 52 inches. The spindle is 6 inches in diameter, and the spindle sleeve has a vertical adjustment of 12 inches. Machines similar to the one shown can be built in different sizes. ..... 67

To obtain additional information on equipment described on this page, see lower part of page 270.

## Bumper Polishing and Buffing Machine

A rocking-table, twin-wheel, automatic polishing and buffing machine designed to finish automobile bumpers has been brought out by the Excelsior Tool & Machine Co., Ridge Ave. and 30th St., East St. Louis, Ill. With this machine, the bumpers are reciprocated under the polishing wheels as many times as required to obtain the desired finish. The rocking table is adjustable to suit bumpers of various heights and shapes and to equalize the wheel pressure over the entire face of the work.

The bumpers are held by quick-releasing fixtures that keep the work centered under the polishing wheels. Four bumpers are located on the divided table. Two of these are always in contact with the polishing wheels and in plain view of the operator. This arrangement eliminates over and under polishing and keeps the polishing wheel cost at a minimum. The carriage travel speed is 40 feet per minute, and the length of travel is adjustable. ..... 68

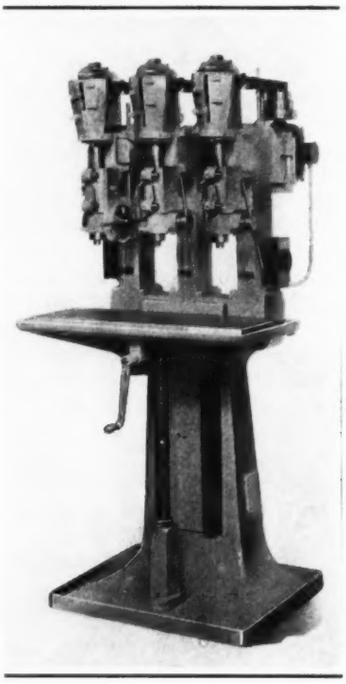
## Taft-Peirce Magnetic Parallels

Magnetic parallels intended for use on any type of magnetic chuck are being announced by the Taft-Peirce Mfg. Co., Woonsocket, R. I. These parallels are carried in stock in two sizes, 3/4 by 1 1/2 by 3 inches, and 1 by 2 by 4 inches. The parallels are made up with alternate laminations of brass and steel. ..... 69

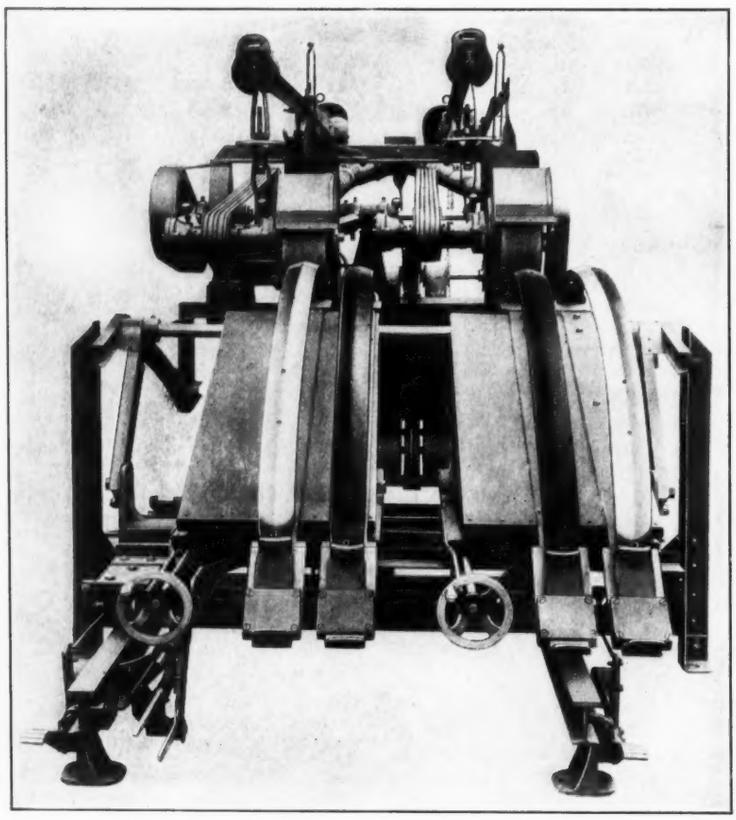
## Multiple-Spindle Sensitive Drilling Machines

Two multiple-spindle, high-speed, ball-bearing drilling machines have recently been added to the "Demco" line, made by the Toledo General Mfg. Co., 3620 Summit Ave., Toledo, Ohio. These machines have vertical motor-driven units with a separate motor for each spindle mounted on a hinged bracket. Each bracket is equipped with a belt take-up, controlled from the front of the machine. A belt-shifting mechanism permits changing quickly to any one of the four spindle speeds regularly available through the cone pulleys. Eight speeds can be obtained by employing two-speed motors.

The regular speeds for the smaller machine, which has a capacity for drilling 3/8-inch holes, are 1900, 3600, 6400, and 12,000 revolutions per minute, with the motor operating at 1800 revolutions per minute. For the larger machine, which has a capacity for drilling 5/8-inch holes, the spindle speeds are 685, 1370, 2000, and 3400 revolutions per minute, with the motor operating at 1725 revolutions per minute. Both models can be furnished with a power feed and with any number of spindles from one to six. ..... 70



Toledo High-speed Multiple-spindle Drilling Machine



Bumper Polishing and Buffing Machine Built by the Excelsior Tool & Machine Co.



To obtain additional information on equipment described on this page, see lower part of page 270.

## Bliss 1000-Ton Hydro-Dynamic Press

Adjustability of stroke and electric finger-tip control are features of a 1000-ton hydraulic press recently brought out by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio. The finger-tip control is employed for production operation and for "inching." Three speeds forward and a high-speed return are available. The three forward speeds comprise a high-speed positive advance of 1100 inches a minute, an intermediate pressing speed of 60 inches a minute and a slow pressing speed of 20 inches a minute.

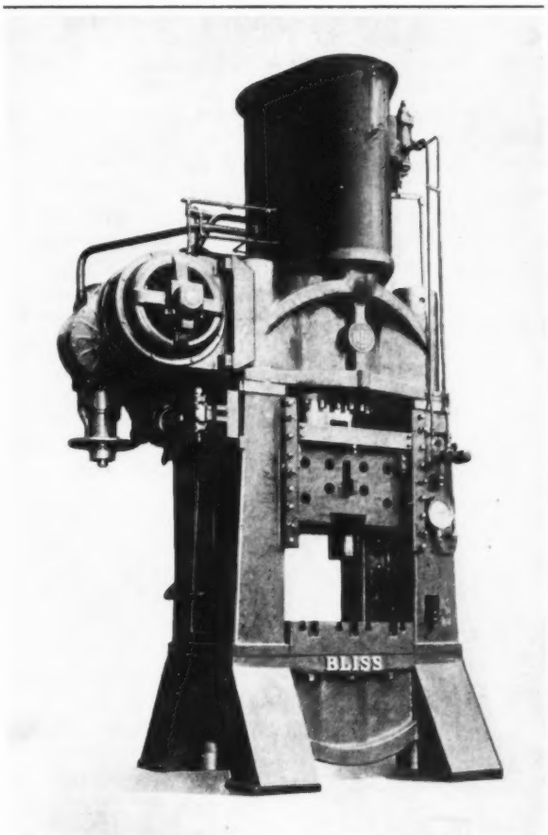
The change from one speed to another is controlled automatically as the pressure increases. The machine is set for operation at capacities either under or over 250 tons by simply turning a switch. Push-buttons are provided for emergency stopping at any position of the stroke, and the press can be restarted in either direction. "Inching" is accomplished by operating electric push-buttons after turning the selector switch from the "run" to the "jog" position.

The hydraulic cushion for blank-holding has a capacity of 100 tons, the pressure exerted being indicated at all times. An air filter, oil filter, and oil cooler with a thermostatically controlled water inlet valve are furnished. The press is designed to operate continuously at about sixteen cycles per minute under full automatic control. .....71

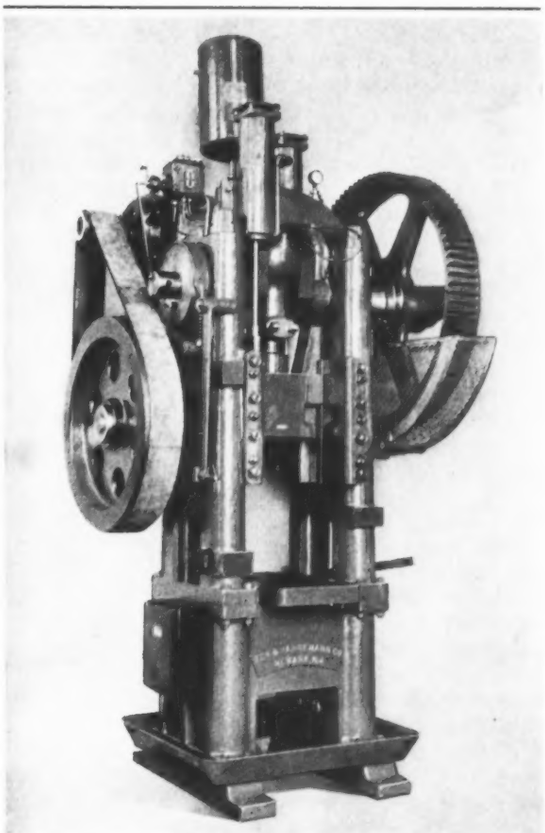
## Zeh & Hahnemann Straight-Sided Press with Balancing Cylinders

A straight-sided single-crank press having a capacity of 75 tons has recently been built by the Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J. This machine is of built-up tie-rod construction and is equipped with balancing cylinders for the slide—the first application of balancing cylinders made by the concern on presses having a long stroke. The maximum stroke of the machine is 12 inches.

The machine is equipped with an individual motor drive, and Norma-Hoffmann roller bearings are employed in the construction. The bed area from front to back and from right to left is 20 by 19 inches. The weight of the machine with motor is 11,000 pounds. The press will make up to 50 strokes per minute.....72




Bliss Hydro-Dynamic Press Equipped with Finger-tip Control

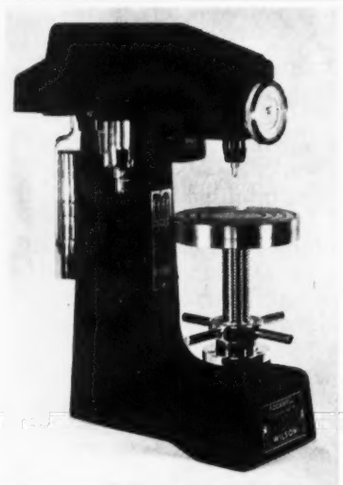


Zeh & Hahnemann Straight-sided Press with Balancing Cylinders for the Slide

To obtain additional information on equipment described on this page, see lower part of page 270.

## Rockwell Hardness Testers for Use in Dusty Atmospheres

All sizes of the Rockwell hardness tester made by the Wilson Mechanical Instrument Co., Inc., 382 Concord Ave., New York City, are now obtainable with a hinged cowl that is designed to shield the testing head from grit and dust in heat-treating departments. The cowl swivels on trunnions, so that the head mechanism can be instantly exposed for inspection and for adjustments.



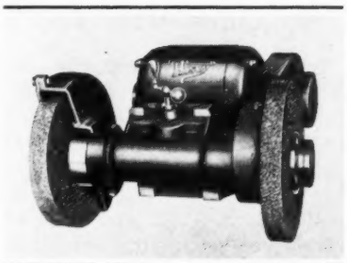
Hardness Tester with Dust-protection Cowl

Sealed ball bearings have been provided at several places in the head to facilitate smoothness of operation. An improved valve system in the oil dashpot insures the effectiveness of the speed adjustment, even at the beginning of the stroke. Changes made in the depth measuring system provide greater precision. The work support for 1/4-inch or larger rods and other cylindrical shapes has been changed from a V-notch to two adjacent hardened and ground cylinders, which will accommodate a greater range of diameters. 73

## Hisey-Wolf Two-Wheel Wide-Range Grinders

A two-wheel grinder of wide range, made in six sizes ranging from 1 to 10 horsepower for wheels from 8 to 20 inches in diameter, has been brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio. These grinders are particularly adapted for grinding rolls where end space is limited, and the larger sizes are also adapted for grinding car wheels.

Constant-speed, dynamically balanced, alternating- and direct-current motors are used. A dovetail slide with a screw feed and handle affords rapid adjustment of the wheel to and from the work without affecting the belt tension.



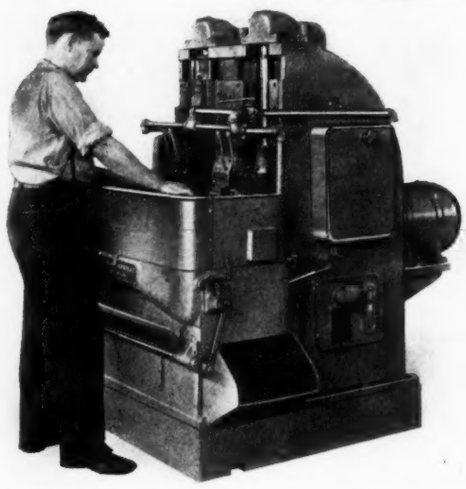
Hisey-Wolf Precision Grinding Machine

The grinding wheel is reversible through the motor, and the spindle is mounted in ball bearings. All oil used to lubricate the machine is filtered automatically, and the bearings are protected by seals. ..... 74

## Continuous Broaching Machine for Connecting-Rods

Connecting-rods and caps are broached on their joint faces at a production rate of 400 an hour on an alternating-cycle, dual-ram, broaching machine built by the Colonial Broach Co., Detroit, Mich. The machine has a stroke of 18 inches. A broaching pressure of three tons is used for each ram, one ram being used to broach the joint faces of the rods, while the other is used for the caps.

The operation is completely automatic. While the left-hand ram is broaching a cap on the downward stroke, the right-hand ram moves upward after having broached a rod. During this up stroke, the fixture holding the rod is automatically swung outward and the clamps released, so that the operator can remove the finished rod and insert a new one. Toward the end of the same stroke, the part is automatically clamped and the fixture returned to the broaching position.



Colonial Broaching Machine Used for Machining Connecting-rods and Caps

As the right-hand ram travels downward, the left-hand ram travels upward, going through the same cycle as that followed by the right-hand ram during its upward stroke. All operations, including the actuation of the fixtures and clamps, are performed hydraulically. ..... 75

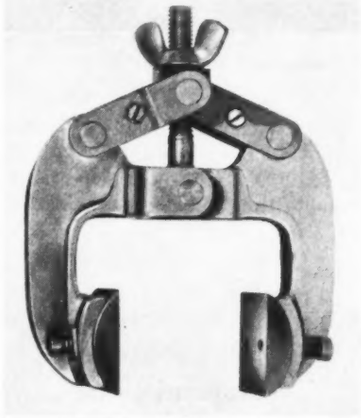


To obtain additional information on equipment described on this page, see lower part of page 270.

## Clampco Toggle C-Clamp

Toggle C-clamps of the construction here illustrated are now being made in two sizes by the Howe Machinery Co., Inc., 30 Gregory Ave., Passaic, N. J. The jaw openings of the two sizes are from 0 to 1 1/2 inches and from 1 1/2 to 3 inches.

Power equivalent to that obtainable with a lever 18 inches in length is developed by merely turning the small thumb-screw to exert pressure against the toggle levers. Another feature of the clamps is the fact that the hardened jaw plates remain parallel in relation to the faces of the part being clamped, so that there is no tendency for the clamp to loosen after being tightened on work. ....76



Toggle C-Clamp Available in Two Sizes

## Pyro Micro-Optical Pyrometer

A precision instrument for measuring the temperatures of very small objects, such as incandescent lamp filaments, etc., and for laboratory and scientific research work, has been brought out by the Pyrometer Instrument Co., 103 Lafayette St., New York. This instrument, known as the Pyro Micro-Optical pyrometer, provides a twenty-fold magnification of the object by means of an optical arrangement of high candlepower. The instrument is furnished with a rigid support and tripod, the instrument-holder being equipped with a precision gear arrangement that permits accurate adjustment in any desired direction for focussing on any spot or object.

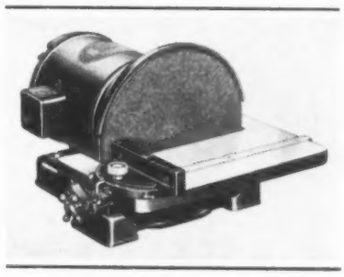
A precision ammeter with built-in battery is attached to the instrument, which operates on the principle of the "disappearing filament." It is furnished with the following scale ranges: 600 to 1600 degrees C.; 1600 to 3000 degrees C.; and 3000 to 4000 degrees C., or the equivalent in degrees F. ....77

Micro-Optical Pyrometer Brought out by the Pyrometer Instrument Co.

## Delta Disk Sanders for Metal and Wood

Two disk sanders designed to meet the requirements of machine, pattern, and cabinet shops have been placed on the market by the Delta Mfg. Co., 627 E. Vienna Ave., Milwaukee, Wis. These machines are heavy enough for accurate finishing, squaring, mitering, fitting, and sanding of wood, metal, plastics, and other materials. They are of a portable design.

The model illustrated is direct-driven through either a 1/2- or a 3/4-horsepower motor. The other model is belt-driven, and is intended for use with an existing drive or in applications where motors of unusual voltage or frequency must be used. Both models are equipped with 12-inch disks and 10- by 16-inch tilting tables with graduated sectors for easily obtaining desired angles of tilt. A 3/8- by 3/4-inch groove in the table facilitates the use of a miter gage and special fixtures. The shaft of the belt-driven machine is carried in self-sealed ball bearings which do not require lubrication. A sawdust blower is available. ....78



Delta Disk Sander Available in Motor- and Belt-driven Models

## Electrode for Alternating-Current Welders

A mild-steel arc-welding electrode designed especially for use with small alternating-current transformer type arc-welders has been brought out by the Lincoln Electric Co., Cleveland, Ohio. This electrode, designated as "Transweld," has a heavy extruded coating.

The advantages claimed for this electrode are a stable arc, ease in striking and holding, and facility in making welds in smooth, well shaped beads. Another advantage is the ease with which slag can be removed from the metal deposited. The weld metal has a tensile strength of 75,000 to 85,000 pounds per square inch, a yield point of 60,000 to 68,000 pounds per square inch,

To obtain additional information on equipment described on this page, see lower part of page 270.

and an elongation of 20 to 30 per cent in 2 inches.

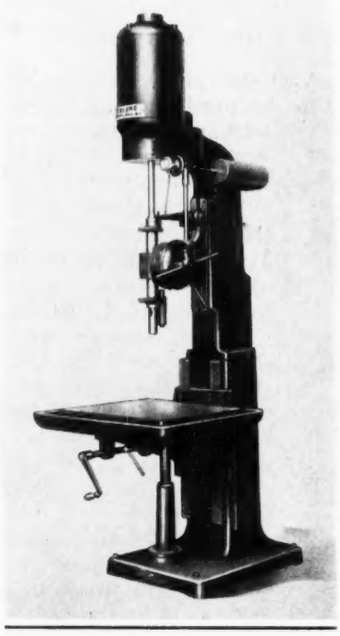
This electrode is made in sizes of 3/32, 1/8, and 5/32 inch. It will operate equally well with direct current of either straight or reversed polarity. ..... 79

## Edlund Motor-on-Spindle Drilling Machines

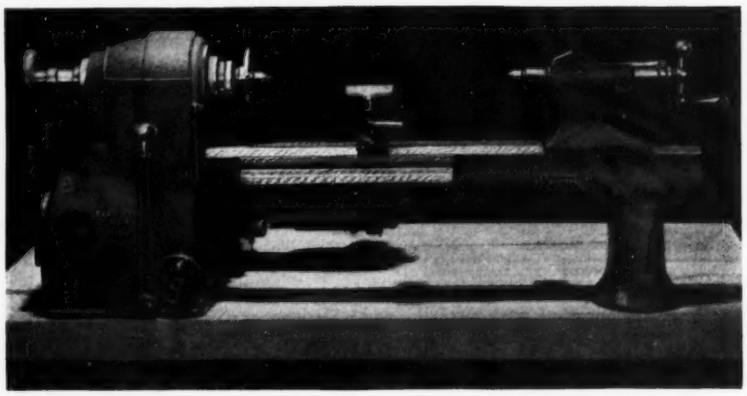
Drilling machines with the motor mounted directly on the spindle have been brought out by the Edlund Machinery Co., Inc., Cortland, N. Y., in sizes having an overhang of 8, 12, and 15 inches. From one to eight spindles can be provided on these machines and they can be equipped with a ball-bearing back-gear, semi-automatic power feed, reversing motor and controls for tapping, and equipment for supplying coolant to the work and spindles.

Speeds of 600, 900, 1200, and 1800 revolutions per minute or 600, 1200, 1800, and 3600 revolutions per minute can be provided. Speeds are selected by turning a knob on the front of the machine, and are indicated by a dial. On multiple-spindle machines, the motors can be stopped individually through a drum control or the entire machine can be stopped by means of a foot control.

The semi-automatic power feed engages when the drill touches the work. The depth of feed can be regulated by means of a dial, and the feed can also be disengaged by simply raising the feed-lever. ..... 80



Edlund Drilling Machine with Motor on Spindle



Stark Precision Bench Lathe with Integral Drive

## Stark Integral-Drive Precision Bench Lathe

A self-contained precision bench lathe with built-in motor and speed-changing mechanism has been brought out by the Stark Tool Co., Waltham, Mass. A ball-bearing, 1/2-horsepower motor drives the lathe spindle through a disk clutch, variable V-belt sheaves, and V-belts to the headstock. This arrangement gives any speed between 156 and 2200 revolutions per minute for the standard model, or any speed between 300 and 3000 revolutions per minute for the high-speed model. The swing is 9 inches, and the bed length 40 inches for both models, which are made in two collet sizes of 3/4 inch and 1 inch capacity.

Speeds are changed instantly by means of a handwheel, and are registered on an indicator mounted on the switch column. The standard model is equipped with a hardened spindle and adjustable tapered bronze bearings, and the high-speed model is fitted with anti-friction bearings. These lathes take all attachments made by the company, except the milling attachment. ..... 81

## Speedmaster Wide-Range Variable-Speed Transmission

A transmission unit designed to give a wide range of speeds has recently been placed on the market by the Speedmaster Co., 1301 Washington Ave., S., Min-

Variable-speed Unit of Wide Range



To obtain additional information on equipment described on this page, see lower part of page 270.

neapolis, Minn. This unit employs standard V-belts which run over adjustable Bakelite pulleys. In the unit illustrated, a speed range of 90 to 4300 revolutions per minute is available at the output shaft. This gives a ratio of 45 to 1 in a relatively small, compact unit.

Speed changes are made by operating a handwheel. A dial speed indicator is built into the unit. The output shaft can be coupled directly to the driven part or it can be provided with a V-belt pulley.

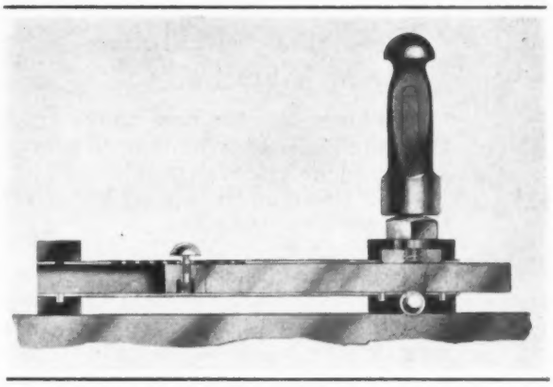
A 1 1/2-horsepower motor is mounted on the top of the unit shown, but it can be located in various positions on the housing or inside the housing. In the latter case, the entire unit can be utilized as a base or leg of the driven machine. ..... 82

## Frosto Freeze Preventive for Air Lines

A freeze preventive known as Frosto has been added to the products of the Sullivan Machinery Co., Michigan City, Ind., for use in compressed-air lines. This freeze preventive has been developed particularly for industrial applications, electric current being necessary for its operation. From a vaporizer, Frosto is fed into the compressed-air line near the compressor as fast as necessary to prevent the freezing of water vapor in the lines or tools. ..... 83

## Portable Brinell Hardness Testing Instrument

A light-weight portable hardness testing instrument designated the "Telebrineller," which can be easily carried to the job, has been developed by Teleweld, Inc., Railway Exchange Bldg., Chicago, Ill. This instrument was originally designed for use in railroad rail maintenance for checking and controlling the rebuilding of rail ends by welding and heat-treatment. It can be used in close quarters and applied to work that cannot be carried to a laboratory for testing, such as welded sections of oil-pipe lines.



Using Teleweld Hardness Tester

The complete outfit weighs 6 1/2 pounds, and consists of the Telebrineller instrument, a bar of known hardness, a microscope with an etched scale located in its focal plane, a slide-rule, extra test bars and impression balls, and a carrying case. The instrument itself consists of a metal tube supported in a soft rubber head, a rubber spacing block, a tube that holds the bar of known hardness, and an anvil in the top of the rubber head which rests directly on the bar of known hardness. Below the latter bar is placed the impression ball in a narrow aperture in the base of the head. The ball is located in direct contact with the metal to be tested.

In use, the instrument is held against the specimen, as shown in the illustration, and the anvil is struck a sharp blow with a 3- to 5-pound hammer. The impact is transmitted through the anvil to the bar, then to the ball, and finally to the specimen under test. The force of the blow may vary without affecting the results, the diameter of the impression in the bar and in the specimen being, in any case, relative to their individual Brinell hardness number ratings. The diameter of the impressions is measured in 1/10 millimeters by placing the microscope over each impression in turn and reading the scale. The Brinell hardness number is then obtained by a simple arithmetical formula or by slide-rule settings. ..... 84

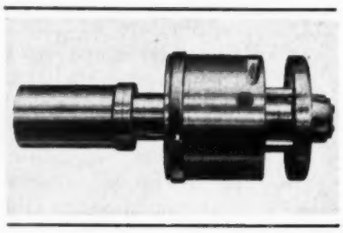
## Borm Welder for Light and Heavy Metal

An alternating-current arc welder designed to operate as easily and efficiently on thin metal as on heavy metal has been developed by the Borm Mfg. Co., Elgin, Ill. This welder will handle 1/16- to 3/16-inch welding rod. Tests indicate that the operating cost for electricity is about 5 cents an hour.

The welder is built in a non-metallic case. It is mounted on rollers and can be easily carried or moved about. Twelve heat ranges are provided, and the head on the cabinet is so designed that the desired heat can be easily selected. It is claimed that practically any mechanic can easily hold an arc when using this equipment. ..... 85

Borm Alternating-current Arc Welder

To obtain additional information on equipment described on this page, see lower part of page 270.



Landis Collapsible Tap with Simple Adjustment for Taper

## Landis Receding-Chaser Collapsible Tap

A receding-chaser collapsible tap known as the 3ALM has been placed on the market by the Landis Machine Co., Inc., Waynesboro, Pa., primarily for tapping couplings and similar parts. This tap can be applied to any machine that employs a live spindle and on which the receding action can be accomplished automatically, there being no manually operated model.

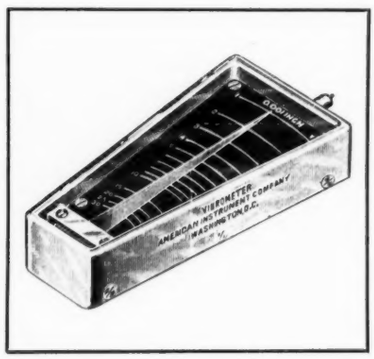
The internal mechanism is similar to that of the standard LM tap in that it employs a cross-rail slide cam to control the taper. The tap can be tripped at any position by merely adjusting a bar to come in contact with a tripping button located in the body of the tap near the shank end.

An unusually simple adjustment is provided for making taper changes and taper correction. Threads of any taper up to 3/4 inch per foot can be cut, and taper changes can be made in infinitesimal amounts from zero to maximum. It is merely necessary to release a locking screw in the control collar and move the taper indicator.

Another feature is the method of directing coolant to the cutting edges of the chasers. Coolant is admitted to the tap through a bronze yoke ring at the rear of the control collar, and through the hollow tripping ring supports into the tripping ring, which is also hollow. The faceplate of this ring is perforated with small holes, so located that the entire volume of coolant is directed within the coupling being threaded. The range of this tap is for threads from 2 to 4 inches, inclusive. .....86

## Vibrometer for Measuring Amplitude of Vibration

A Vibrometer for measuring the amplitude of vibration of structural or machine members is being placed on the market by the American Instrument Co., 8015 Georgia Ave., Silver Spring, Md. The amplitude range of this instrument is from 0.001 to 0.030 inch. In use, the instrument is simply held in the hand with the needle point against the vibrating part whose amplitude is to be measured.




Vibration Measuring Instrument Brought out by the American Instrument Co.

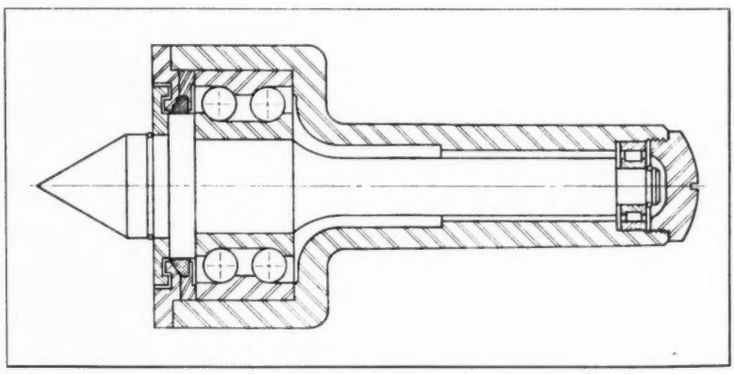
The vibrating motion of the spindle is transmitted directly to the Vibrometer pointer, which is bright yellow and moves on a black background. The pointer appears "double" to the eye of the observer, and the apparent intersection of the two images, read on the scale on the background, gives the amplitude of vibration directly in thousandths of an inch. The instrument weighs two pounds. .....87

## Red-E Ball-Bearing Center

A tailstock center of the live-spindle type with the spindle mounted in two bearings, as shown in the accompanying illustration, has just been brought out by the Ready Tool Co., 550 Iranistan Ave., Bridgeport, Conn. A double-row preloaded angular-contact precision bearing is used at the front end to give both radial and axial rigidity. A single-row self-aligning roller bearing is used at the rear end to give maximum radial load capacity and permit using a spindle of large diameter to prevent deflection of the center point.

A complete labyrinth seal with woven felt washers is used to eliminate any possibility of dirt, chips, or cutting compound entering the bearing. This seal also prevents the leakage of lubricant. Both bearings are lubricated with a sufficient amount of special roll grease to last for the life of the bearings.

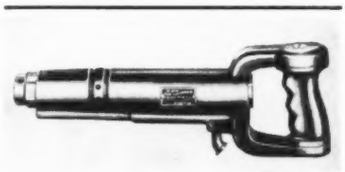
After assembly, the center is rotated in the bearings while the point is ground, in order to insure accurate alignment. All parts are machined to close tolerances from alloy steel and are designed for heavy duty and long service. .....88



Tailstock Center Equipped with Ball and Roller Bearings, Made by the Ready Tool Co.



To obtain additional information on equipment described on this page, see lower part of page 270.



Elgin Pneumatic Hammer of Triggerless Design

## Elgin Triggerless Pneumatic Hammer

A triggerless pneumatic hammer with a tool-holder designed to lock the tool in position has been placed on the market by the Borm Mfg. Co., Elgin, Ill. To operate this tool, it is simply necessary to insert the drill, chisel, or other tool, and press the end of the tool against the work. This causes the air valve to open and the tool to start automatically. The hammer is stopped by merely releasing the pressure or withdrawing the tool from contact with the work. The tools are locked in the holder, but can be easily inserted or removed.

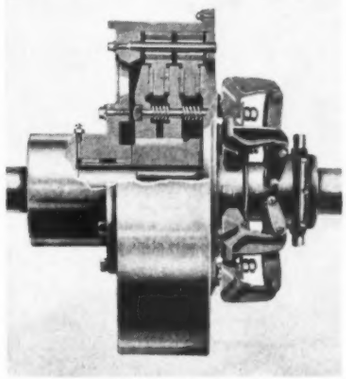
This hammer is made in three models. Model B is a light, powerful hammer intended for general use. It will handle star drills up to and including the 1-inch size, and is suitable for light-weight chipping, scaling, and light spade work. Model C is a more powerful hammer than Model B, and will handle 1 1/4-inch star drills. The Model D hammer operates at higher speed than the two smaller models, and is especially designed for foundry work, riveting, etc. ..... 89

## Wood's Friction Clutches with Rubber-Cushioned Driving Pins

A friction clutch that is designed especially for use on oil, gas, and Diesel engine drives, but is adapted for other applications where heavy impact is encountered on either end of the driving unit is being added to the line of friction clutches made by the T. B. Wood's Sons Co., Chambersburg, Pa.

This new clutch, designated the Universal Giant, is made in both single- and double-disk types. The outstanding feature is the use of rubber-cushioned driving pins, which eliminate knocks, absorb shocks, and are claimed to add considerably to the life of the clutches.

The rubber bushings which cushion the driving pins have self-lubricating bronze bushings on the inside of the rubber, so that the disks slide freely on the steel pins. The rubber is cemented firmly to the friction



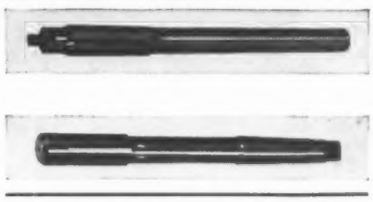
Wood's Double-disk Flexible Friction Clutch

disks. The single-disk clutches are made in twelve sizes, the smallest having capacity for transmitting 15 horsepower at 100 revolutions per minute, and the largest 240 horsepower at 100 revolutions per minute.

The double-disk clutches are made in nine sizes, ranging in capacity from 30 to 240 horsepower at 100 revolutions per minute. ..... 90

## Morse Cemented-Carbide Tipped Reamers

A line of reamers tipped with cemented carbide is being introduced on the market in standard sizes by the Morse Tool Co., 116 E. Golden Gate Ave., Detroit, Mich. These reamers are available in both expansion and solid types, with either straight or tapered shanks. They are carried



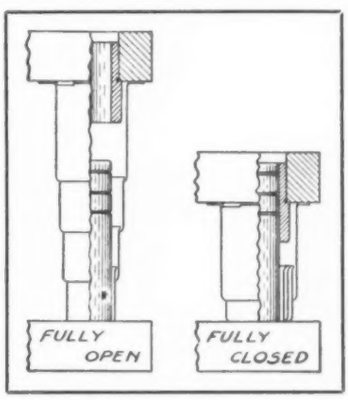
Carbide-tipped Reamers Made in Standard Sizes

in stock, so that immediate deliveries are assured.

In addition to this standard line of reamers, the company manufactures reamers and other cutting tools to meet individual requirements. ..... 91

## Wiesman Leader-Pin Covers for Dies

A line of telescoping leader-pin covers designed to guard the press operator against injury and prevent chips and dirt from reaching the leader pins and bushings of large and small dies is being placed on the market by the Wiesman Mfg. Co., 31-35 S. St. Clair St., Dayton, Ohio. The covers, when fitted on the pins, have a telescopic action, as indicated in the accompanying illustration, which eliminates any open space between the pin and the die. Holes are provided in the flanges of the covers which serve as jigs for drilling screw-holes in the punch-holder for attaching the covers. The covers can be removed for oiling the pins or for use on other dies. ..... 92




Diagrams Showing Application of Wiesman Leader-pin Covers

To obtain additional information on equipment described on this page, see lower part of page 270.

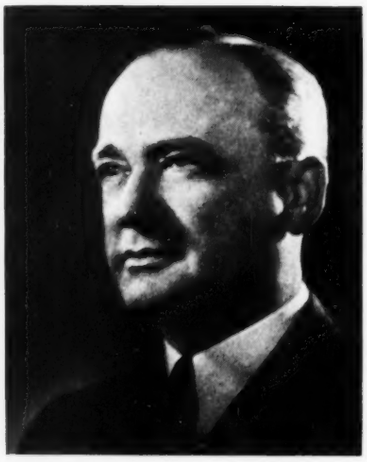
# Recently Elected Officers of the National Machine Tool Builders' Association

© Bachrach

*(Left) H. W. Dunbar, of the Norton Co., President of the National Machine Tool Builders' Association*

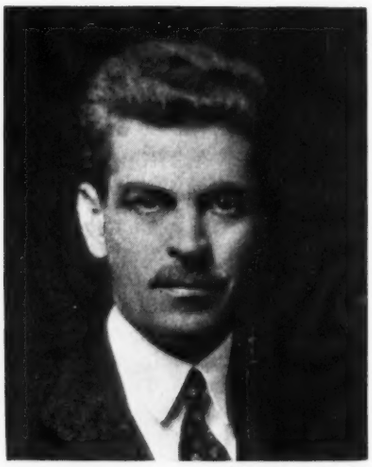
*(Right) N. A. Woodworth, of the Ex-Cell-O Corporation, First Vice-president*

Greystone Studios, Inc



*(Left) W. E. Whipp, of the Monarch Machine Tool Co., Second Vice-president*

*(Right) T. H. Doan, of the Foote-Burt Co., Treasurer of the Association*



Blackstone Studios

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933,**

of MACHINERY, published monthly at New York, N. Y., for October 1, 1937.

State of New York }
County of New York } ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, 140-148 Lafayette St., New York; Erik Oberg, 140-148 Lafayette St., New York; Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; Laura A. Brownell, 140-148 Lafayette St., New York; Franklin D. Jones, 140-148 Lafayette St., New York; First National Bank & Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.

3. That the known bondholders, mortgagees or other security holders are: Laura A. Brownell, 140-148 Lafayette St., New York; John Connolly, 140-148 Lafayette St., New York; Franklin D. Jones, 140-148 Lafayette St., New York; Robert B. Luchars, 140-148 Lafayette St., New York; Louis Pelletier, 140-148 Lafayette St., New York; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt., and Henry V. Oberg, 28 Spencer Ave, Lancaster, Pa.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder, or security holder, appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 21st day of September, 1937

CHARLES P. ABEL,
Notary Public, Kings County No. 302
Kings Register's No. 9126

(SEAL)

New York County No. 197, New York Register's No. 9-A-147
(My commission expires March 30, 1939)